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The Pan book of MATHEMATICAL TABLES

compiled by A. MONTAGUE-BEART

An important new reference book — for the student and for everyone in the expanding technical professions

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THE PAN BOOK OF
MATHEMATICAL TABLES

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A. MONTAGUE-BEART

A PAN ORIGINAL

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11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
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14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14	17	20	22	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
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23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
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26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
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37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
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60	.7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
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64	.8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
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67	.8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	.8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	5	5	6
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71	.8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	.8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	.8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	.8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	.8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
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81	.9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
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83	.9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	3	4	5
84	.9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	3	4	5
85	.9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	.9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	4
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88	.9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	.9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	.9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	.9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	.9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	.9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	.9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	.9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	.9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	.9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	.9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	.9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

ANTI-LOGARITHMS

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.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
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.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2
.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2
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.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	2
.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	2	2	2	2	2
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.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2	2	2	3	3
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.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
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.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	5	5	6
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.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	2	2	3	4	5	5	6	6

ANTI-LOGARITHMS

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.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7
.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7
.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	6	7	8	10	11	12
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	12	14
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15
.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	3	5	7	9	10	12	14	16
.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20

LOG. SINES

Page 10 (degrees 0°–21°):

°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	—∞	3̄·242	3̄·543	3̄·719	3̄·844	3̄·941	2̄·020	2̄·087	2̄·145	2̄·196					
1	2̄·2419	2̄·2832	2̄·3210	2̄·3558	2̄·3880	2̄·4179	2̄·4459	2̄·4723	2̄·4971	2̄·5206					
2	2̄·5428	2̄·5640	2̄·5842	2̄·6035	2̄·6220	2̄·6397	2̄·6567	2̄·6731	2̄·6889	2̄·7041					
3	2̄·7188	2̄·7330	2̄·7468	2̄·7602	2̄·7731	2̄·7857	2̄·7979	2̄·8098	2̄·8213	2̄·8326	21	41	62	83	103
4	2̄·8436	2̄·8543	2̄·8647	2̄·8749	2̄·8849	2̄·8946	2̄·9042	2̄·9135	2̄·9226	2̄·9315	16	32	48	64	81
5	2̄·9403	2̄·9489	2̄·9573	2̄·9655	2̄·9736	2̄·9816	2̄·9894	2̄·9970	1̄·0046	1̄·0120	13	26	39	53	66
6	1̄·0192	1̄·0264	1̄·0334	1̄·0403	1̄·0472	1̄·0539	1̄·0605	1̄·0670	1̄·0734	1̄·0797	11	22	33	44	55
7	1̄·0859	1̄·0920	1̄·0981	1̄·1040	1̄·1099	1̄·1157	1̄·1214	1̄·1271	1̄·1326	1̄·1381	10	19	29	38	48
8	1̄·1436	1̄·1489	1̄·1542	1̄·1594	1̄·1646	1̄·1697	1̄·1747	1̄·1797	1̄·1847	1̄·1895	8	17	25	34	42
9	1̄·1943	1̄·1991	1̄·2038	1̄·2085	1̄·2131	1̄·2176	1̄·2221	1̄·2266	1̄·2310	1̄·2353	8	15	23	30	38
10	1̄·2397	1̄·2439	1̄·2482	1̄·2524	1̄·2565	1̄·2606	1̄·2647	1̄·2687	1̄·2727	1̄·2767	7	14	20	27	34
11	1̄·2806	1̄·2845	1̄·2883	1̄·2921	1̄·2959	1̄·2997	1̄·3034	1̄·3070	1̄·3107	1̄·3143	6	12	19	25	31
12	1̄·3179	1̄·3214	1̄·3250	1̄·3284	1̄·3319	1̄·3353	1̄·3387	1̄·3421	1̄·3455	1̄·3488	6	11	17	23	28
13	1̄·3521	1̄·3554	1̄·3586	1̄·3618	1̄·3650	1̄·3682	1̄·3713	1̄·3745	1̄·3775	1̄·3806	5	11	16	21	26
14	1̄·3837	1̄·3867	1̄·3897	1̄·3927	1̄·3957	1̄·3986	1̄·4015	1̄·4044	1̄·4073	1̄·4102	5	10	15	20	24
15	1̄·4130	1̄·4158	1̄·4186	1̄·4214	1̄·4242	1̄·4269	1̄·4296	1̄·4323	1̄·4350	1̄·4377	5	9	14	18	23
16	1̄·4403	1̄·4430	1̄·4456	1̄·4482	1̄·4508	1̄·4533	1̄·4559	1̄·4584	1̄·4609	1̄·4634	4	9	13	17	21
17	1̄·4659	1̄·4684	1̄·4709	1̄·4733	1̄·4757	1̄·4781	1̄·4805	1̄·4829	1̄·4853	1̄·4876	4	8	12	16	20
18	1̄·4900	1̄·4923	1̄·4946	1̄·4969	1̄·4992	1̄·5015	1̄·5037	1̄·5060	1̄·5082	1̄·5104	4	8	11	15	19
19	1̄·5126	1̄·5148	1̄·5170	1̄·5192	1̄·5213	1̄·5235	1̄·5256	1̄·5278	1̄·5299	1̄·5320	4	7	11	14	18
20	1̄·5341	1̄·5361	1̄·5382	1̄·5402	1̄·5423	1̄·5443	1̄·5463	1̄·5484	1̄·5504	1̄·5523	3	7	10	14	17
21	1̄·5543	1̄·5563	1̄·5583	1̄·5602	1̄·5621	1̄·5641	1̄·5660	1̄·5679	1̄·5698	1̄·5717	3	6	10	13	16

Page 11 (degrees 22°–44°):

°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
22	1̄·5736	1̄·5754	1̄·5773	1̄·5792	1̄·5810	1̄·5828	1̄·5847	1̄·5865	1̄·5883	1̄·5901	3	6	9	12	15
23	1̄·5919	1̄·5937	1̄·5954	1̄·5972	1̄·5990	1̄·6007	1̄·6024	1̄·6042	1̄·6059	1̄·6076	3	6	9	12	15
24	1̄·6093	1̄·6110	1̄·6127	1̄·6144	1̄·6161	1̄·6177	1̄·6194	1̄·6210	1̄·6227	1̄·6243	3	6	8	11	14
25	1̄·6259	1̄·6276	1̄·6292	1̄·6308	1̄·6324	1̄·6340	1̄·6356	1̄·6371	1̄·6387	1̄·6403	3	5	8	11	13
26	1̄·6418	1̄·6434	1̄·6449	1̄·6465	1̄·6480	1̄·6495	1̄·6510	1̄·6526	1̄·6541	1̄·6556	3	5	8	10	13
27	1̄·6570	1̄·6585	1̄·6600	1̄·6615	1̄·6629	1̄·6644	1̄·6659	1̄·6673	1̄·6687	1̄·6702	2	5	7	10	12
28	1̄·6716	1̄·6730	1̄·6744	1̄·6759	1̄·6773	1̄·6787	1̄·6801	1̄·6814	1̄·6828	1̄·6842	2	5	7	9	12
29	1̄·6856	1̄·6869	1̄·6883	1̄·6896	1̄·6910	1̄·6923	1̄·6937	1̄·6950	1̄·6963	1̄·6977	2	4	7	9	11
30	1̄·6990	1̄·7003	1̄·7016	1̄·7029	1̄·7042	1̄·7055	1̄·7068	1̄·7080	1̄·7093	1̄·7106	2	4	6	9	11
31	1̄·7118	1̄·7131	1̄·7144	1̄·7156	1̄·7168	1̄·7181	1̄·7193	1̄·7205	1̄·7218	1̄·7230	2	4	6	8	10
32	1̄·7242	1̄·7254	1̄·7266	1̄·7278	1̄·7290	1̄·7302	1̄·7314	1̄·7326	1̄·7338	1̄·7349	2	4	6	8	10
33	1̄·7361	1̄·7373	1̄·7384	1̄·7396	1̄·7407	1̄·7419	1̄·7430	1̄·7442	1̄·7453	1̄·7464	2	4	6	8	10
34	1̄·7476	1̄·7487	1̄·7498	1̄·7509	1̄·7520	1̄·7531	1̄·7542	1̄·7553	1̄·7564	1̄·7575	2	4	6	7	9
35	1̄·7586	1̄·7597	1̄·7607	1̄·7618	1̄·7629	1̄·7640	1̄·7650	1̄·7661	1̄·7671	1̄·7682	2	4	5	7	9
36	1̄·7692	1̄·7703	1̄·7713	1̄·7723	1̄·7734	1̄·7744	1̄·7754	1̄·7764	1̄·7774	1̄·7785	2	3	5	7	9
37	1̄·7795	1̄·7805	1̄·7815	1̄·7825	1̄·7835	1̄·7844	1̄·7854	1̄·7864	1̄·7874	1̄·7884	2	3	5	7	8
38	1̄·7893	1̄·7903	1̄·7913	1̄·7922	1̄·7932	1̄·7941	1̄·7951	1̄·7960	1̄·7970	1̄·7979	2	3	5	6	8
39	1̄·7989	1̄·7998	1̄·8007	1̄·8017	1̄·8026	1̄·8035	1̄·8044	1̄·8053	1̄·8063	1̄·8072	2	3	5	6	8
40	1̄·8081	1̄·8090	1̄·8099	1̄·8108	1̄·8117	1̄·8125	1̄·8134	1̄·8143	1̄·8152	1̄·8161	1	3	4	6	7
41	1̄·8169	1̄·8178	1̄·8187	1̄·8195	1̄·8204	1̄·8213	1̄·8221	1̄·8230	1̄·8238	1̄·8247	1	3	4	6	7
42	1̄·8255	1̄·8264	1̄·8272	1̄·8280	1̄·8289	1̄·8297	1̄·8305	1̄·8313	1̄·8322	1̄·8330	1	3	4	5	7
43	1̄·8338	1̄·8346	1̄·8354	1̄·8362	1̄·8370	1̄·8378	1̄·8386	1̄·8394	1̄·8402	1̄·8410	1	3	4	5	7
44	1̄·8418	1̄·8426	1̄·8433	1̄·8441	1̄·8449	1̄·8457	1̄·8464	1̄·8472	1̄·8480	1̄·8487	1	3	4	5	6

The black type indicates that the integer changes.

LOG. SINES

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	1̄.8495	8502	8510	8517	8525	8532	8540	8547	8555	8562	1	2	4	5	6
46	1̄.8569	8577	8584	8591	8598	8606	8613	8620	8627	8634	1	2	4	5	6
47	1̄.8641	8648	8655	8662	8669	8676	8683	8690	8697	8704	1	2	4	5	6
48	1̄.8711	8718	8724	8731	8738	8745	8751	8758	8765	8771	1	2	3	4	6
49	1̄.8778	8784	8791	8797	8804	8810	8817	8823	8830	8836	1	2	3	4	5
50	1̄.8843	8849	8855	8862	8868	8874	8880	8887	8893	8899	1	2	3	4	5
51	1̄.8905	8911	8917	8923	8929	8935	8941	8947	8953	8959	1	2	3	4	5
52	1̄.8965	8971	8977	8983	8989	8995	9000	9006	9012	9018	1	2	3	4	5
53	1̄.9023	9029	9035	9041	9046	9052	9057	9063	9069	9074	1	2	3	4	5
54	1̄.9080	9085	9091	9096	9101	9107	9112	9118	9123	9128	1	2	3	4	4
55	1̄.9134	9139	9144	9149	9155	9160	9165	9170	9175	9181	1	2	3	3	4
56	1̄.9186	9191	9196	9201	9206	9211	9216	9221	9226	9231	1	2	3	3	4
57	1̄.9236	9241	9246	9251	9255	9260	9265	9270	9275	9279	1	2	2	3	4
58	1̄.9284	9289	9294	9298	9303	9308	9312	9317	9322	9326	1	2	2	3	4
59	1̄.9331	9335	9340	9344	9349	9353	9358	9362	9367	9371	1	2	2	3	4
60	1̄.9375	9380	9384	9388	9393	9397	9401	9406	9410	9414	1	1	2	3	4
61	1̄.9418	9422	9427	9431	9435	9439	9443	9447	9451	9455	1	1	2	3	3
62	1̄.9459	9463	9467	9471	9475	9479	9483	9487	9491	9495	1	1	2	3	3
63	1̄.9499	9503	9506	9510	9514	9518	9522	9525	9529	9533	1	1	2	3	3
64	1̄.9537	9540	9544	9548	9551	9555	9558	9562	9566	9569	1	1	2	2	3
65	1̄.9573	9576	9580	9583	9587	9590	9594	9597	9601	9604	1	1	2	2	3
66	1̄.9607	9611	9614	9617	9621	9624	9627	9631	9634	9637	1	1	2	2	3
67	1̄.9640	9643	9647	9650	9653	9656	9659	9662	9666	9669	1	1	2	2	3
68	1̄.9672	9675	9678	9681	9684	9687	9690	9693	9696	9699	0	1	1	2	2
69	1̄.9702	9704	9707	9710	9713	9716	9719	9722	9724	9727	0	1	1	2	2
70	1̄.9730	9733	9735	9738	9741	9743	9746	9749	9751	9754	0	1	1	2	2
71	1̄.9757	9759	9762	9764	9767	9770	9772	9775	9777	9780	0	1	1	2	2
72	1̄.9782	9785	9787	9789	9792	9794	9797	9799	9801	9804	0	1	1	2	2
73	1̄.9806	9808	9811	9813	9815	9817	9820	9822	9824	9826	0	1	1	1	2
74	1̄.9828	9831	9833	9835	9837	9839	9841	9843	9845	9847	0	1	1	1	2
75	1̄.9849	9851	9853	9855	9857	9859	9861	9863	9865	9867	0	1	1	1	2
76	1̄.9869	9871	9873	9875	9876	9878	9880	9882	9884	9885	0	1	1	1	1
77	1̄.9887	9889	9891	9892	9894	9896	9897	9899	9901	9902	0	1	1	1	1
78	1̄.9904	9906	9907	9909	9910	9912	9913	9915	9916	9918	0	0	1	1	1
79	1̄.9919	9921	9922	9924	9925	9927	9928	9929	9931	9932	0	0	1	1	1
80	1̄.9934	9935	9936	9937	9939	9940	9941	9943	9944	9945	0	0	1	1	1
81	1̄.9946	9947	9949	9950	9951	9952	9953	9954	9955	9956	0	0	1	1	1
82	1̄.9958	9959	9960	9961	9962	9963	9964	9965	9966	9967	0	0	1	1	1
83	1̄.9968	9968	9969	9970	9971	9972	9973	9974	9975	9975	0	0	0	1	1
84	1̄.9976	9977	9978	9978	9979	9980	9981	9981	9982	9983	0	0	0	1	1
85	1̄.9983	9984	9985	9985	9986	9987	9987	9988	9988	9989	0	0	0	0	0
86	1̄.9989	9990	9990	9991	9991	9992	9992	9993	9993	9994	0	0	0	0	0
87	1̄.9994	9994	9995	9995	9996	9996	9996	9996	9997	9997	0	0	0	0	0
88	1̄.9997	9998	9998	9998	9998	9999	9999	9999	9999	9999	0	0	0	0	0
89	1̄.9999	9999	9999	0000	0000	0000	0000	0000	0000	0000	0	0	0	0	0

The black type indicates that the integer changes.

Deg	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0°	0·0000	0000	0000	0000	0000	0000	0000	0000	0000	9999					
1	1̄·9999	9999	9999	9999	9999	9999	9998	9998	9998	9998					
2	1̄·9997	9997	9997	9996	9996	9996	9996	9995	9995	9994					
3	1̄·9994	9994	9993	9993	9992	9992	9991	9991	9990	9990	0	0	0	1	1
4	1̄·9989	9989	9988	9988	9987	9987	9986	9985	9985	9984	0	0	1	1	1
5	1̄·9983	9983	9982	9981	9981	9980	9979	9978	9978	9977	0	0	1	1	1
6	1̄·9976	9975	9975	9974	9973	9972	9971	9970	9969	9968	0	0	1	1	1
7	1̄·9968	9967	9966	9965	9964	9963	9962	9961	9960	9959	0	1	1	1	1
8	1̄·9958	9956	9955	9954	9953	9952	9951	9950	9949	9947	0	1	1	1	2
9	1̄·9946	9945	9944	9943	9941	9940	9939	9937	9936	9935	0	1	1	1	2
10	1̄·9934	9932	9931	9929	9928	9927	9925	9924	9922	9921	0	1	1	2	2
11	1̄·9919	9918	9916	9915	9913	9912	9910	9909	9907	9906	0	1	1	2	2
12	1̄·9904	9902	9901	9899	9897	9896	9894	9892	9891	9889	0	1	1	2	2
13	1̄·9887	9885	9884	9882	9880	9878	9876	9875	9873	9871	0	1	1	2	2
14	1̄·9869	9867	9865	9863	9861	9859	9857	9855	9853	9851	0	1	1	2	2
15	1̄·9849	9847	9845	9843	9841	9839	9837	9835	9833	9831	0	1	1	2	2
16	1̄·9828	9826	9824	9822	9820	9817	9815	9813	9811	9808	0	1	1	2	2
17	1̄·9806	9804	9801	9799	9797	9794	9792	9789	9787	9785	0	1	1	2	2
18	1̄·9782	9780	9777	9775	9772	9770	9767	9764	9762	9759	0	1	1	2	2
19	1̄·9757	9754	9751	9749	9746	9743	9741	9738	9735	9733	0	1	1	2	2
20	1̄·9730	9727	9724	9722	9719	9716	9713	9710	9707	9704	0	1	1	2	2
21	1̄·9702	9699	9696	9693	9690	9687	9684	9681	9678	9675	0	1	1	2	2
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

Deg	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
22	1̄·9672	9669	9666	9662	9659	9656	9653	9650	9647	9643	1	1	2	2	3
23	1̄·9640	9637	9634	9631	9627	9624	9621	9617	9614	9611	1	1	2	2	3
24	1̄·9607	9604	9601	9597	9594	9590	9587	9583	9580	9576	1	1	2	2	3
25	1̄·9573	9569	9566	9562	9558	9555	9551	9548	9544	9540	1	1	2	2	3
26	1̄·9537	9533	9529	9525	9522	9518	9514	9510	9506	9503	1	1	2	3	3
27	1̄·9499	9495	9491	9487	9483	9479	9475	9471	9467	9463	1	1	2	3	3
28	1̄·9459	9455	9451	9447	9443	9439	9435	9431	9427	9422	1	1	2	3	3
29	1̄·9418	9414	9410	9406	9401	9397	9393	9388	9384	9380	1	1	2	3	4
30	1̄·9375	9371	9367	9362	9358	9353	9349	9344	9340	9335	1	1	2	3	4
31	1̄·9331	9326	9322	9317	9312	9308	9303	9298	9294	9289	1	2	2	3	4
32	1̄·9284	9279	9275	9270	9265	9260	9255	9251	9246	9241	1	2	2	3	4
33	1̄·9236	9231	9226	9221	9216	9211	9206	9201	9196	9191	1	2	3	3	4
34	1̄·9186	9181	9175	9170	9165	9160	9155	9149	9144	9139	1	2	3	3	4
35	1̄·9134	9128	9123	9118	9112	9107	9101	9096	9091	9085	1	2	3	4	5
36	1̄·9080	9074	9069	9063	9057	9052	9046	9041	9035	9029	1	2	3	4	5
37	1̄·9023	9018	9012	9006	9000	8995	8989	8983	8977	8971	1	2	3	4	5
38	1̄·8965	8959	8953	8947	8941	8935	8929	8923	8917	8911	1	2	3	4	5
39	1̄·8905	8899	8893	8887	8880	8874	8868	8862	8855	8849	1	2	3	4	5
40	1̄·8843	8836	8830	8823	8817	8810	8804	8797	8791	8784	1	2	3	4	5
41	1̄·8778	8771	8765	8758	8751	8745	8738	8731	8724	8718	1	2	3	4	6
42	1̄·8711	8704	8697	8690	8683	8676	8669	8662	8655	8648	1	2	3	5	6
43	1̄·8641	8634	8627	8620	8613	8606	8598	8591	8584	8577	1	2	4	5	6
44	1̄·8569	8562	8555	8547	8540	8532	8525	8517	8510	8502	1	2	4	5	6
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

	0′	6′	12′	18′	24′	30′	36′	42′	48′	54′	1′	2′	3′	4′	5′
45°	1̄·8495	8487	8480	8472	8464	8457	8449	8441	8433	8426	1	3	4	5	6
46	1̄·8418	8410	8402	8394	8386	8378	8370	8362	8354	8346	1	3	4	5	7
47	1̄·8338	8330	8322	8313	8305	8297	8289	8280	8272	8264	1	3	4	6	7
48	1̄·8255	8247	8238	8230	8221	8213	8204	8195	8187	8178	1	3	4	6	7
49	1̄·8169	8161	8152	8143	8134	8125	8117	8108	8099	8090	1	3	4	6	7
50	1̄·8081	8072	8063	8053	8044	8035	8026	8017	8007	7998	2	3	5	6	8
51	1̄·7989	7979	7970	7960	7951	7941	7932	7922	7913	7903	2	3	5	6	8
52	1̄·7893	7884	7874	7864	7854	7844	7835	7825	7815	7805	2	3	5	7	8
53	1̄·7795	7785	7774	7764	7754	7744	7734	7723	7713	7703	2	3	5	7	8
54	1̄·7692	7682	7671	7661	7650	7640	7629	7618	7607	7597	2	4	5	7	9
55	1̄·7586	7575	7564	7553	7542	7531	7520	7509	7498	7487	2	4	5	7	9
56	1̄·7476	7464	7453	7442	7430	7419	7407	7396	7384	7373	2	4	6	8	10
57	1̄·7361	7349	7338	7326	7314	7302	7290	7278	7266	7254	2	4	6	8	10
58	1̄·7242	7230	7218	7205	7193	7181	7168	7156	7144	7131	2	4	6	8	10
59	1̄·7118	7106	7093	7080	7068	7055	7042	7029	7016	7003	2	4	6	9	11
60	1̄·6990	6977	6963	6950	6937	6923	6910	6896	6883	6869	2	4	7	9	11
61	1̄·6856	6842	6828	6814	6801	6787	6773	6759	6744	6730	2	5	7	9	12
62	1̄·6716	6702	6687	6673	6659	6644	6629	6615	6600	6585	2	5	7	10	12
63	1̄·6570	6556	6541	6526	6510	6495	6480	6465	6449	6434	3	5	8	10	13
64	1̄·6418	6403	6387	6371	6356	6340	6324	6308	6292	6276	3	5	8	11	13
65	1̄·6259	6243	6227	6210	6194	6177	6161	6144	6127	6110	3	6	8	11	14
66	1̄·6093	6076	6059	6042	6024	6007	5990	5972	5954	5937	3	6	9	12	15
67	1̄·5919	5901	5883	5865	5847	5828	5810	5792	5773	5754	3	6	9	12	15
68	1̄·5736	5717	5698	5679	5660	5641	5621	5602	5583	5563	3	6	10	13	16
69	1̄·5543	5523	5504	5484	5463	5443	5423	5402	5382	5361	3	7	10	14	17
70	1̄·5341	5320	5299	5278	5256	5235	5213	5192	5170	5148	4	7	11	14	18
71	1̄·5126	5104	5082	5060	5037	5015	4992	4969	4946	4923	4	8	11	15	19
72	1̄·4900	4876	4853	4829	4805	4781	4757	4733	4709	4684	4	8	12	16	20
73	1̄·4659	4634	4609	4584	4559	4533	4508	4482	4456	4430	4	8	13	17	21
74	1̄·4403	4377	4350	4323	4296	4269	4242	4214	4186	4158	5	9	14	18	23
75	1̄·4130	4102	4073	4044	4015	3986	3957	3927	3897	3867	5	10	15	20	24
76	1̄·3837	3806	3775	3745	3713	3682	3650	3618	3586	3554	5	11	16	21	26
77	1̄·3521	3488	3455	3421	3387	3353	3319	3284	3250	3214	6	11	17	23	28
78	1̄·3179	3143	3107	3070	3034	2997	2959	2921	2883	2845	6	12	19	25	31
79	1̄·2806	2767	2727	2687	2647	2606	2565	2524	2482	2439	7	14	20	27	34
80	1̄·2397	2353	2310	2266	2221	2176	2131	2085	2038	1991	8	15	23	30	38
81	1̄·1943	1895	1847	1797	1747	1697	1646	1594	1542	1489	8	17	25	34	42
82	1̄·1436	1381	1326	1271	1214	1157	1099	1040	0981	0920	10	19	29	38	48
83	1̄·0859	0797	0734	0670	0605	0539	0472	0403	0334	0264	11	22	33	44	55
84	1̄·0192	0120	0046	9970	9894	9816	9736	9655	9573	9489	13	26	39	53	66
85	2̄·9403	9315	9226	9135	9042	8946	8849	8749	8647	8543	16	32	48	64	81
86	2̄·8436	8326	8213	8098	7979	7857	7731	7602	7468	7330	21	41	62	83	103
87	2̄·7188	7041	6889	6731	6567	6397	6220	6035	5842	5640					
88	2̄·5428	5206	4971	4723	4459	4179	3880	3558	3210	2832		Differences			
89	3̄·242	2·196	2·145	2·087	2·020	3̄·941	3̄·844	3̄·719	3̄·543	3̄·242		untrustworthy			
	0′	6′	12′	18′	24′	30′	36′	42′	48′	54′	1′	2′	3′	4′	5′

The black type indicates that the integer changes.

LOG. TANGENTS

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0°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0°	−∞	3̄·242	3̄·543	3̄·719	3̄·844	3̄·941	2̄·020	2̄·087	2̄·145	2̄·196	21	42	63	83	104
1	2̄·2419	2833	3211	3559	3881	4181	4461	4725	4973	5208	16	32	48	65	81
2	2̄·5431	5643	5845	6038	6223	6401	6571	6736	6894	7046					
3	2̄·7194	7337	7475	7609	7739	7865	7988	8107	8223	8336					
4	2̄·8446	8554	8659	8762	8862	8960	9056	9150	9241	9331					
5	2̄·9420	9506	9591	9674	9756	9836	9915	9992	0068	0143	13	26	40	53	66
6	1̄·0216	0289	0360	0430	0499	0567	0633	0699	0764	0828	11	22	34	45	56
7	1̄·0891	0954	1015	1076	1135	1194	1252	1310	1367	1423	10	20	29	39	49
8	1̄·1478	1533	1587	1640	1693	1745	1797	1848	1898	1948	9	17	26	35	43
9	1̄·1997	2046	2094	2142	2189	2236	2282	2328	2374	2419	8	16	23	31	39
10	1̄·2463	2507	2551	2594	2637	2680	2722	2764	2805	2846	7	14	21	28	35
11	1̄·2887	2927	2967	3006	3046	3085	3123	3162	3200	3237	6	13	19	26	32
12	1̄·3275	3312	3349	3385	3422	3458	3493	3529	3564	3599	6	12	18	24	30
13	1̄·3634	3668	3702	3736	3770	3804	3837	3870	3903	3935	6	11	17	22	28
14	1̄·3968	4000	4032	4064	4095	4127	4158	4189	4220	4250	5	10	16	21	26
15	1̄·4281	4311	4341	4371	4400	4430	4459	4488	4517	4546	5	10	15	20	25
16	1̄·4575	4603	4632	4660	4688	4716	4744	4771	4799	4826	5	9	14	19	23
17	1̄·4853	4880	4907	4934	4961	4987	5014	5040	5066	5092	4	9	13	18	22
18	1̄·5118	5143	5169	5195	5220	5245	5270	5295	5320	5345	4	8	13	17	21
19	1̄·5370	5394	5419	5443	5467	5491	5516	5539	5563	5587	4	8	12	16	20
20	1̄·5611	5634	5658	5681	5704	5727	5750	5773	5796	5819	4	8	12	15	19
21	1̄·5842	5864	5887	5909	5932	5954	5976	5998	6020	6042	4	7	11	15	19
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

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	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
22°	1̄·6064	6086	6108	6129	6151	6172	6194	6215	6236	6257	4	7	11	14	18
23	1̄·6279	6300	6321	6341	6362	6383	6404	6424	6445	6465	3	7	10	14	17
24	1̄·6486	6506	6527	6547	6567	6587	6607	6627	6647	6667	3	7	10	13	17
25	1̄·6687	6706	6726	6746	6765	6785	6804	6824	6843	6863	3	7	10	13	16
26	1̄·6882	6901	6920	6939	6958	6977	6996	7015	7034	7053	3	6	9	13	16
27	1̄·7072	7090	7109	7128	7146	7165	7183	7202	7220	7238	3	6	9	12	15
28	1̄·7257	7275	7293	7311	7330	7348	7366	7384	7402	7420	3	6	9	12	15
29	1̄·7438	7455	7473	7491	7509	7526	7544	7562	7579	7597	3	6	9	12	15
30	1̄·7614	7632	7649	7667	7684	7701	7719	7736	7753	7771	3	6	9	12	14
31	1̄·7788	7805	7822	7839	7856	7873	7890	7907	7924	7941	3	6	8	11	14
32	1̄·7958	7975	7992	8008	8025	8042	8059	8075	8092	8109	3	5	8	11	14
33	1̄·8125	8142	8158	8175	8191	8208	8224	8241	8257	8274	3	5	8	11	14
34	1̄·8290	8306	8323	8339	8355	8371	8388	8404	8420	8436	3	5	8	11	14
35	1̄·8452	8468	8484	8501	8517	8533	8549	8565	8581	8597	3	5	8	11	13
36	1̄·8613	8629	8644	8660	8676	8692	8708	8724	8740	8755	3	5	8	11	13
37	1̄·8771	8787	8803	8818	8834	8850	8865	8881	8897	8912	3	5	8	10	13
38	1̄·8928	8944	8959	8975	8990	9006	9022	9037	9053	9068	3	5	8	10	13
39	1̄·9084	9099	9115	9130	9146	9161	9176	9192	9207	9223	3	5	8	10	13
40	1̄·9238	9254	9269	9284	9300	9315	9330	9346	9361	9376	3	5	8	10	13
41	1̄·9392	9407	9422	9438	9453	9468	9483	9499	9514	9529	3	5	8	10	13
42	1̄·9544	9560	9575	9590	9605	9621	9636	9651	9666	9681	3	5	8	10	13
43	1̄·9697	9712	9727	9742	9757	9772	9788	9803	9818	9833	3	5	8	10	13
44	1̄·9848	9864	9879	9894	9909	9924	9939	9955	9970	9985	3	5	8	10	13
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

LOG. TANGENTS

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	0·0000	0015	0030	0045	0061	0076	0091	0106	0121	0136	3	5	8	10	13
46	0·0152	0167	0182	0197	0212	0228	0243	0258	0273	0288	3	5	8	10	13
47	0·0303	0319	0334	0349	0364	0379	0395	0410	0425	0440	3	5	8	10	13
48	0·0456	0471	0486	0501	0517	0532	0547	0562	0578	0593	3	5	8	10	13
49	0·0608	0624	0639	0654	0670	0685	0700	0716	0731	0746	3	5	8	10	13
50	0·0762	0777	0793	0808	0824	0839	0854	0870	0885	0901	3	5	8	10	13
51	0·0916	0932	0947	0963	0978	0994	1010	1025	1041	1056	3	5	8	10	13
52	0·1072	1088	1103	1119	1135	1150	1166	1182	1197	1213	3	5	8	10	13
53	0·1229	1245	1260	1276	1292	1308	1324	1340	1356	1371	3	5	8	11	13
54	0·1387	1403	1419	1435	1451	1467	1483	1499	1516	1532	3	5	8	11	13
55	0·1548	1564	1580	1596	1612	1629	1645	1661	1677	1694	3	5	8	11	14
56	0·1710	1726	1743	1759	1776	1792	1809	1825	1842	1858	3	5	8	11	14
57	0·1875	1891	1908	1925	1941	1958	1975	1992	2008	2025	3	6	8	11	14
58	0·2042	2059	2076	2093	2110	2127	2144	2161	2178	2195	3	6	9	11	14
59	0·2212	2229	2247	2264	2281	2299	2316	2333	2351	2368	3	6	9	12	14
60	0·2386	2403	2421	2438	2456	2474	2491	2509	2527	2545	3	6	9	12	15
61	0·2562	2580	2598	2616	2634	2652	2670	2689	2707	2725	3	6	9	12	15
62	0·2743	2762	2780	2798	2817	2835	2854	2872	2891	2910	3	6	9	12	15
63	0·2928	2947	2966	2985	3004	3023	3042	3061	3080	3099	3	6	9	13	16
64	0·3118	3137	3157	3176	3196	3215	3235	3254	3274	3294	3	7	10	13	16
65	0·3313	3333	3353	3373	3393	3413	3433	3453	3473	3494	3	7	10	13	17
66	0·3514	3535	3555	3576	3596	3617	3638	3659	3679	3700	3	7	10	14	17
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67	0·3721	3743	3764	3785	3806	3828	3849	3871	3892	3914	4	7	11	14	18
68	0·3936	3958	3980	4002	4024	4046	4068	4091	4113	4136	4	7	11	15	19
69	0·4158	4181	4204	4227	4250	4273	4296	4319	4342	4366	4	8	12	15	19
70	0·4389	4413	4437	4461	4484	4509	4533	4557	4581	4606	4	8	12	16	20
71	0·4630	4655	4680	4705	4730	4755	4780	4805	4831	4857	4	8	13	17	21
72	0·4882	4908	4934	4960	4986	5013	5039	5066	5093	5120	4	9	13	18	22
73	0·5147	5174	5201	5229	5256	5284	5312	5340	5368	5397	5	9	14	19	23
74	0·5425	5454	5483	5512	5541	5570	5600	5629	5659	5689	5	10	15	20	25
75	0·5719	5750	5780	5811	5842	5873	5905	5936	5968	6000	5	10	16	21	26
76	0·6032	6065	6097	6130	6163	6196	6230	6264	6298	6332	6	11	17	22	28
77	0·6366	6401	6436	6471	6507	6542	6578	6615	6651	6688	6	12	18	24	30
78	0·6725	6763	6800	6838	6877	6915	6954	6994	7033	7073	6	13	19	26	32
79	0·7113	7154	7195	7236	7278	7320	7363	7406	7449	7493	7	14	21	28	35
80	0·7537	7581	7626	7672	7718	7764	7811	7858	7906	7954	8	16	23	31	39
81	0·8003	8052	8102	8152	8203	8255	8307	8360	8413	8467	9	17	26	35	43
82	0·8522	8577	8633	8690	8748	8806	8865	8924	8985	9046	10	18	29	39	49
83	0·9109	9172	9236	9301	9367	9433	9501	9570	9640	9711	11	20	34	45	56
84	0·9784	9857	9932	0008	0085	0164	0244	0326	0409	0494	13	22	40	53	66
85	1·0580	0669	0759	0850	0944	1040	1138	1238	1341	1446	16	32	48	65	81
86	1·1554	1664	1777	1893	2012	2135	2261	2391	2525	2663	21	42	63	83	104
87	1·2806	2954	3106	3264	3429	3599	3777	3962	4155	4357			Differences		
88	1·4569	4792	5027	5275	5539	5819	6119	6441	6789	7167			untrustworthy		
89	1·758	1·804	1·855	1·913	1·980	2·059	2·156	2·281	2·457	2·758			here		
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

LOG. COTANGENTS

Deg	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0°	+∞	2·758	2·457	2·281	2·156	2·059	1·980	1·913	1·855	1·804					
1	1·7581	7167	6789	6441	6119	5819	5539	5275	5027	4792					
2	1·4569	4357	4155	3962	3777	3599	3429	3264	3106	2954					
3	1·2806	2663	2525	2391	2261	2135	2012	1893	1777	1664	21	42	63	83	104
4	1·1554	1446	1341	1238	1138	1040	0944	0850	0759	0669	16	32	48	65	81
5	1·0580	0494	0409	0326	0244	0164	0085	0008	9932	9857	13	26	40	53	66
6	0·9784	9711	9640	9570	9501	9433	9367	9301	9236	9172	11	22	34	45	56
7	0·9109	9046	8985	8924	8865	8806	8748	8690	8633	8577	10	20	29	39	49
8	0·8522	8467	8413	8360	8307	8255	8203	8152	8102	8052	9	17	26	35	43
9	0·8003	7954	7906	7858	7811	7764	7718	7672	7626	7581	8	16	23	31	39
10	0·7537	7493	7449	7406	7363	7320	7278	7236	7195	7154	7	14	21	28	35
11	0·7113	7073	7033	6994	6954	6915	6877	6838	6800	6763	6	13	19	26	32
12	0·6725	6688	6651	6615	6578	6542	6507	6471	6436	6401	6	12	18	24	30
13	0·6366	6332	6298	6264	6230	6196	6163	6130	6097	6065	6	11	17	22	28
14	0·6032	6000	5968	5936	5905	5873	5842	5811	5780	5750	5	10	16	21	26
15	0·5719	5689	5659	5629	5600	5570	5541	5512	5483	5454	5	10	15	20	25
16	0·5425	5397	5368	5340	5312	5284	5256	5229	5201	5174	5	9	14	19	23
17	0·5147	5120	5093	5066	5039	5013	4986	4960	4934	4908	4	9	13	18	22
18	0·4882	4857	4831	4805	4780	4755	4730	4705	4680	4655	4	8	13	17	21
19	0·4630	4606	4581	4557	4533	4509	4484	4461	4437	4413	4	8	12	16	20
20	0·4389	4366	4342	4319	4296	4273	4250	4227	4204	4181	4	8	12	15	19
21	0·4158	4136	4113	4091	4068	4046	4024	4002	3980	3958	4	7	11	15	19
22	0·3936	3914	3892	3871	3849	3828	3806	3785	3764	3743	4	7	11	14	18
23	0·3721	3700	3679	3659	3638	3617	3596	3576	3555	3535	3	7	10	14	17
24	0·3514	3494	3473	3453	3433	3413	3393	3373	3353	3333	3	7	10	13	17
25	0·3313	3294	3274	3254	3235	3215	3196	3176	3157	3137	3	7	10	13	16
26	0·3118	3099	3080	3061	3042	3023	3004	2985	2966	2947	3	6	9	13	16
27	0·2928	2910	2891	2872	2854	2835	2817	2798	2780	2762	3	6	9	12	15
28	0·2743	2725	2707	2689	2670	2652	2634	2616	2598	2580	3	6	9	12	15
29	0·2562	2545	2527	2509	2491	2474	2456	2438	2421	2403	3	6	9	12	15
30	0·2386	2368	2351	2333	2316	2299	2281	2264	2247	2229	3	6	9	12	14
31	0·2212	2195	2178	2161	2144	2127	2110	2093	2076	2059	3	6	9	11	14
32	0·2042	2025	2008	1992	1975	1958	1941	1925	1908	1891	3	6	8	11	14
33	0·1875	1858	1842	1825	1809	1792	1776	1759	1743	1726	3	5	8	11	14
34	0·1710	1694	1677	1661	1645	1629	1612	1596	1580	1564	3	5	8	11	14
35	0·1548	1532	1516	1499	1483	1467	1451	1435	1419	1403	3	5	8	11	13
36	0·1387	1371	1356	1340	1324	1308	1292	1276	1260	1245	3	5	8	11	13
37	0·1229	1213	1197	1182	1166	1150	1135	1119	1103	1088	3	5	8	10	13
38	0·1072	1056	1041	1025	1010	0994	0978	0963	0947	0932	3	5	8	10	13
39	0·0916	0901	0885	0870	0854	0839	0824	0808	0793	0777	3	5	8	10	13
40	0·0762	0746	0731	0716	0700	0685	0670	0654	0639	0624	3	5	8	10	13
41	0·0608	0593	0578	0562	0547	0532	0517	0501	0486	0471	3	5	8	10	13
42	0·0456	0440	0425	0410	0395	0379	0364	0349	0334	0319	3	5	8	10	13
43	0·0303	0288	0273	0258	0243	0228	0212	0197	0182	0167	3	5	8	10	13
44	0·0152	0136	0121	0106	0091	0076	0061	0045	0030	0015	3	5	8	10	13

The black type indicates that the integer changes.

LOG. COTANGENTS — SUBTRACT

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	0·0000	9985	9970	9955	9939	9924	9909	9894	9879	9864	3	5	8	10	13
46	1̄·9848	9833	9818	9803	9788	9772	9757	9742	9727	9712	3	5	8	10	13
47	1̄·9697	9681	9666	9651	9636	9621	9605	9590	9575	9560	3	5	8	10	13
48	1̄·9544	9529	9514	9499	9483	9468	9453	9438	9422	9407	3	5	8	10	13
49	1̄·9392	9376	9361	9346	9330	9315	9300	9284	9269	9254	3	5	8	10	13
50	1̄·9238	9223	9207	9192	9176	9161	9146	9130	9115	9099	3	5	8	10	13
51	1̄·9084	9068	9053	9037	9022	9006	8990	8975	8959	8944	3	5	8	10	13
52	1̄·8928	8912	8897	8881	8865	8850	8834	8818	8803	8787	3	5	8	10	13
53	1̄·8771	8755	8740	8724	8708	8692	8676	8660	8644	8629	3	5	8	11	13
54	1̄·8613	8597	8581	8565	8549	8533	8517	8501	8484	8468	3	5	8	11	13
55	1̄·8452	8436	8420	8404	8388	8371	8355	8339	8323	8306	3	5	8	11	14
56	1̄·8290	8274	8257	8241	8224	8208	8191	8175	8158	8142	3	5	8	11	14
57	1̄·8125	8109	8092	8075	8059	8042	8025	8008	7992	7975	3	6	8	11	14
58	1̄·7958	7941	7924	7907	7890	7873	7856	7839	7822	7805	3	6	9	11	14
59	1̄·7788	7771	7753	7736	7719	7701	7684	7667	7649	7632	3	6	9	12	14
60	1̄·7614	7597	7579	7562	7544	7526	7509	7491	7473	7455	3	6	9	12	15
61	1̄·7438	7420	7402	7384	7366	7348	7330	7311	7293	7275	3	6	9	12	15
62	1̄·7257	7238	7220	7202	7183	7165	7146	7128	7109	7090	3	6	9	12	15
63	1̄·7072	7053	7034	7015	6996	6977	6958	6939	6920	6901	3	6	9	13	16
64	1̄·6882	6863	6843	6824	6804	6785	6765	6746	6726	6706	3	7	10	13	16
65	1̄·6687	6667	6647	6627	6607	6587	6567	6547	6527	6506	3	7	10	13	17
66	1̄·6486	6465	6445	6424	6404	6383	6362	6341	6321	6300	3	7	10	14	17
67	1̄·6279	6257	6236	6215	6194	6172	6151	6129	6108	6086	4	7	11	14	18
68	1̄·6064	6042	6020	5998	5976	5954	5932	5909	5887	5864	4	7	11	15	19
69	1̄·5842	5819	5796	5773	5750	5727	5704	5681	5658	5634	4	8	12	15	19
70	1̄·5611	5587	5563	5539	5516	5491	5467	5443	5419	5394	4	8	12	16	20
71	1̄·5370	5345	5320	5295	5270	5245	5220	5195	5169	5143	4	8	13	17	21
72	1̄·5118	5092	5066	5040	5014	4987	4961	4934	4907	4880	4	9	13	18	22
73	1̄·4853	4826	4799	4771	4744	4716	4688	4660	4632	4603	5	9	14	19	23
74	1̄·4575	4546	4517	4488	4459	4430	4400	4371	4341	4311	5	10	15	20	25
75	1̄·4281	4250	4220	4189	4158	4127	4095	4064	4032	4000	5	10	16	21	26
76	1̄·3968	3935	3903	3870	3837	3804	3770	3736	3702	3668	6	11	17	22	28
77	1̄·3634	3599	3564	3529	3493	3458	3422	3385	3349	3312	6	12	18	24	30
78	1̄·3275	3237	3200	3162	3123	3085	3046	3006	2967	2927	6	13	19	26	32
79	1̄·2887	2846	2805	2764	2722	2680	2637	2594	2551	2507	7	14	21	28	35
80	1̄·2463	2419	2374	2328	2282	2236	2189	2142	2094	2046	8	16	23	31	39
81	1̄·1997	1948	1898	1848	1797	1745	1693	1640	1587	1533	9	17	26	35	43
82	1̄·1478	1423	1367	1310	1252	1194	1135	1076	1015	0954	10	20	29	39	49
83	1̄·0891	0828	0764	0699	0633	0567	0499	0430	0360	0289	11	22	34	45	56
84	1̄·0216	0143	0068	9992	9915	9836	9756	9674	9591	9506	13	26	40	53	66
85	2̄·9420	9331	9241	9150	9056	8960	8862	8762	8659	8554	16	32	48	65	81
86	2̄·8446	8336	8223	8107	7988	7865	7739	7609	7475	7337	21	42	63	83	104
87	2̄·7194	7046	6894	6736	6571	6401	6223	6038	5845	5643			Differences		
88	2̄·5431	5208	4973	4725	4461	4181	3881	3559	3211	2833			untrustworthy		
89	2̄·242	2·196	2·145	2·087	2·020	3̄·941	3̄·844	3̄·719	3̄·543	3̄·242			here		
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

LOG. SECANTS

	0′	6′	12′	18′	24′	30′	36′	42′	48′	54′	1′	2′	3′	4′	5′
0°	0·0000	0000	0000	0000	0000	0000	0000	0000	0000	0001					
1	0·0001	0001	0001	0001	0001	0001	0002	0002	0002	0002					
2	0·0003	0003	0003	0004	0004	0004	0004	0005	0005	0006					
3	0·0006	0006	0007	0007	0008	0008	0009	0009	0010	0010					
4	0·0011	0011	0012	0012	0013	0013	0014	0015	0015	0016					
5	0·0017	0017	0018	0019	0019	0020	0021	0022	0022	0023	0	0	0	1	1
6	0·0024	0025	0025	0026	0027	0028	0029	0030	0031	0032	0	0	0	1	1
7	0·0032	0033	0034	0035	0036	0037	0038	0039	0040	0041	0	0	1	1	1
8	0·0042	0044	0045	0046	0047	0048	0049	0050	0051	0053	0	0	1	1	2
9	0·0054	0055	0056	0057	0059	0060	0061	0063	0064	0065	0	0	1	1	2
10	0·0066	0068	0069	0071	0072	0073	0075	0076	0078	0079	0	0	1	1	1
11	0·0081	0082	0084	0085	0087	0088	0090	0091	0093	0094	0	1	1	1	1
12	0·0096	0098	0099	0101	0103	0104	0106	0108	0109	0111	0	1	1	1	1
13	0·0113	0115	0116	0118	0120	0122	0124	0125	0127	0129	0	1	1	1	2
14	0·0131	0133	0135	0137	0139	0141	0143	0145	0147	0149	0	1	1	1	2
15	0·0151	0153	0155	0157	0159	0161	0163	0165	0167	0169	0	1	1	1	2
16	0·0172	0174	0176	0178	0180	0183	0185	0187	0189	0192	0	1	1	2	2
17	0·0194	0196	0199	0201	0203	0206	0208	0211	0213	0215	0	1	1	2	2
18	0·0218	0220	0223	0225	0228	0230	0233	0236	0238	0241	0	1	1	2	2
19	0·0243	0246	0249	0251	0254	0257	0259	0262	0265	0267	0	1	1	2	2
20	0·0270	0273	0276	0278	0281	0284	0287	0290	0293	0296	0	1	1	2	2
21	0·0298	0301	0304	0307	0310	0313	0316	0319	0322	0325	0	1	1	2	2
22	0·0328	0331	0334	0338	0341	0344	0347	0350	0353	0357	1	1	2	2	3
23	0·0360	0363	0366	0369	0373	0376	0379	0383	0386	0389	1	1	2	2	3
24	0·0393	0396	0399	0403	0406	0410	0413	0417	0420	0424	1	1	2	2	3
25	0·0427	0431	0434	0438	0442	0445	0449	0452	0456	0460	1	1	2	2	3
26	0·0463	0467	0471	0475	0478	0482	0486	0490	0494	0497	1	1	2	3	3
27	0·0501	0505	0509	0513	0517	0521	0525	0529	0533	0537	1	1	2	3	3
28	0·0541	0545	0549	0553	0557	0561	0565	0569	0573	0578	1	1	2	3	3
29	0·0582	0586	0590	0594	0599	0603	0607	0612	0616	0620	1	1	2	3	4
30	0·0625	0629	0633	0638	0642	0647	0651	0656	0660	0665	1	1	2	3	4
31	0·0669	0674	0678	0683	0688	0692	0697	0702	0706	0711	1	2	2	3	4
32	0·0716	0721	0725	0730	0735	0740	0745	0749	0754	0759	1	2	2	3	4
33	0·0764	0769	0774	0779	0784	0789	0794	0799	0804	0809	1	2	3	3	4
34	0·0814	0819	0825	0830	0835	0840	0845	0851	0856	0861	1	2	3	3	4
35	0·0866	0872	0877	0882	0888	0893	0899	0904	0909	0915	1	2	3	4	5
36	0·0920	0926	0931	0937	0943	0948	0954	0959	0965	0971	1	2	3	4	5
37	0·0977	0982	0988	0994	1000	1005	1011	1017	1023	1029	1	2	3	4	5
38	0·1035	1041	1047	1053	1059	1065	1071	1077	1083	1089	1	2	3	4	5
39	0·1095	1101	1107	1113	1120	1126	1132	1138	1145	1151	1	2	3	4	5
40	0·1157	1164	1170	1177	1183	1190	1196	1203	1209	1216	1	2	3	4	5
41	0·1222	1229	1235	1242	1249	1255	1262	1269	1276	1282	1	2	3	4	6
42	0·1289	1296	1303	1310	1317	1324	1331	1338	1345	1352	1	2	3	5	6
43	0·1359	1366	1373	1380	1387	1394	1402	1409	1416	1423	1	2	4	5	6
44	0·1431	1438	1445	1453	1460	1468	1475	1483	1490	1498	1	2	4	5	6

LOG. SECANTS

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	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	0·1505	1513	1520	1528	1536	1543	1551	1559	1567	1574	1	3	4	5	6
46	0·1582	1590	1598	1606	1614	1622	1630	1638	1646	1654	1	3	4	5	7
47	0·1662	1670	1678	1687	1695	1703	1711	1720	1728	1736	1	3	4	6	7
48	0·1745	1753	1762	1770	1779	1787	1796	1805	1813	1822	1	3	4	6	7
49	0·1831	1839	1848	1857	1866	1875	1883	1892	1901	1910	1	3	4	6	7
50	0·1919	1928	1937	1947	1956	1965	1974	1983	1993	2002	2	3	5	6	8
51	0·2011	2021	2030	2040	2049	2059	2068	2078	2087	2097	2	3	5	6	8
52	0·2107	2116	2126	2136	2146	2156	2165	2175	2185	2195	2	3	5	7	8
53	0·2205	2215	2226	2236	2246	2256	2266	2277	2287	2297	2	3	5	7	9
54	0·2308	2318	2329	2339	2350	2360	2371	2382	2393	2403	2	4	5	7	9
55	0·2414	2425	2436	2447	2458	2469	2480	2491	2502	2513	2	4	5	7	9
56	0·2524	2536	2547	2558	2570	2581	2593	2604	2616	2627	2	4	6	8	10
57	0·2639	2651	2662	2674	2686	2698	2710	2722	2734	2746	2	4	6	8	10
58	0·2758	2770	2782	2795	2807	2819	2832	2844	2856	2869	2	4	6	8	10
59	0·2882	2894	2907	2920	2932	2945	2958	2971	2984	2997	2	4	6	9	11
60	0·3010	3023	3037	3050	3063	3077	3090	3104	3117	3131	2	4	7	9	11
61	0·3144	3158	3172	3186	3199	3213	3227	3241	3256	3270	2	5	7	9	12
62	0·3284	3298	3313	3327	3341	3356	3371	3385	3400	3415	2	5	7	10	12
63	0·3430	3444	3459	3474	3490	3505	3520	3535	3551	3566	3	5	8	10	13
64	0·3582	3597	3613	3629	3644	3660	3676	3692	3708	3724	3	5	8	11	13
65	0·3741	3757	3773	3790	3806	3823	3839	3856	3873	3890	3	6	8	11	14
66	0·3907	3924	3941	3958	3976	3993	4010	4028	4046	4063	3	6	9	12	15
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

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	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67	0·4081	4099	4117	4135	4153	4172	4190	4208	4227	4246	3	6	9	12	15
68	0·4264	4283	4302	4321	4340	4359	4379	4398	4417	4437	3	6	10	13	16
69	0·4457	4477	4496	4516	4537	4557	4577	4598	4618	4639	3	7	10	14	17
70	0·4659	4680	4701	4722	4744	4765	4787	4808	4830	4852	4	7	11	14	18
71	0·4874	4896	4918	4940	4963	4985	5008	5031	5054	5077	4	8	11	15	19
72	0·5100	5124	5147	5171	5195	5219	5243	5267	5291	5316	4	8	12	16	20
73	0·5341	5366	5391	5416	5441	5467	5492	5518	5544	5570	4	9	13	17	21
74	0·5597	5623	5650	5677	5704	5731	5758	5786	5814	5842	5	9	14	18	23
75	0·5870	5898	5927	5956	5985	6014	6043	6073	6103	6133	5	10	15	20	24
76	0·6163	6194	6225	6255	6287	6318	6350	6382	6414	6446	5	11	16	21	26
77	0·6479	6512	6545	6579	6613	6647	6681	6716	6750	6786	6	11	17	23	28
78	0·6821	6857	6893	6930	6966	7003	7041	7079	7117	7155	6	12	19	25	31
79	0·7194	7233	7273	7313	7353	7394	7435	7476	7518	7561	7	14	20	27	34
80	0·7603	7647	7690	7734	7779	7824	7869	7915	7962	8009	8	15	23	30	38
81	0·8057	8105	8153	8203	8253	8303	8354	8406	8458	8511	8	17	25	34	42
82	0·8564	8619	8674	8729	8786	8843	8901	8960	9019	9080	10	19	29	38	48
83	0·9141	9203	9266	9330	9395	9461	9528	9597	9666	9736	11	22	33	44	55
84	0·9808	9880	9954	0030	0106	0184	0264	0345	0427	0511	13	26	39	53	66
85	1·0597	0685	0774	0865	0958	1054	1151	1251	1353	1457	16	32	48	64	81
86	1·1564	1674	1787	1902	2021	2143	2269	2398	2532	2670	21	41	62	83	103
87	1·2812	2959	3111	3269	3433	3603	3780	3965	4158	4360	Differences untrustworthy here				
88	1·4572	4794	5029	5277	5541	5821	6120	6442	6790	7168					
89	1·7581	1·804	1·855	1·913	1·980	2·059	2·156	2·281	2·457	2·758					
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	+∞	2·7758	2·457	2·281	2·156	2·059	1·980	1·913	1·855	1·804					
1	1·7581	7168	6790	6442	6120	5821	5541	5277	5029	4794					
2	1·4572	4360	4158	3965	3780	3603	3433	3269	3111	2959					
3	1·2812	2670	2532	2398	2269	2143	2021	1902	1787	1674	21	41	62	83	103
4	1·1564	1457	1353	1251	1151	1054	0958	0865	0774	0685	16	32	48	64	81
5	1·0597	0511	0427	0345	0264	0184	0106	0030	9954	9880	13	26	39	53	66
6	0·9808	9736	9666	9597	9528	9461	9395	9330	9266	9203	11	22	33	44	55
7	0·9141	9080	9019	8960	8901	8843	8786	8729	8674	8619	10	19	29	38	48
8	0·8564	8511	8458	8406	8354	8303	8253	8203	8153	8105	8	17	25	34	42
9	0·8057	8009	7962	7915	7869	7824	7779	7734	7690	7647	8	15	23	30	38
10	0·7603	7561	7518	7476	7435	7394	7353	7313	7273	7233	7	14	20	27	34
11	0·7194	7155	7117	7079	7041	7003	6966	6930	6893	6857	6	12	19	25	31
12	0·6821	6786	6750	6716	6681	6647	6613	6579	6545	6512	6	11	17	23	28
13	0·6479	6446	6414	6382	6350	6318	6287	6255	6225	6194	5	11	16	21	26
14	0·6163	6133	6103	6073	6043	6014	5985	5956	5927	5898	5	10	15	20	24
15	0·5870	5842	5814	5786	5758	5731	5704	5677	5650	5623	5	9	14	18	23
16	0·5597	5570	5544	5518	5492	5467	5441	5416	5391	5366	4	9	13	17	21
17	0·5341	5316	5291	5267	5243	5219	5195	5171	5147	5124	4	8	12	16	20
18	0·5100	5077	5054	5031	5008	4985	4963	4940	4918	4896	4	8	11	15	19
19	0·4874	4852	4830	4808	4787	4765	4744	4722	4701	4680	4	7	11	14	18
20	0·4659	4639	4618	4598	4577	4557	4537	4516	4496	4477	3	7	10	14	17
21	0·4457	4437	4417	4398	4379	4359	4340	4321	4302	4283	3	6	10	13	16
22	0·4264	4246	4227	4208	4190	4172	4153	4135	4117	4099	3	6	9	12	15
23	0·4081	4063	4046	4028	4010	3993	3976	3958	3941	3924	3	6	9	12	15
24	0·3907	3890	3873	3856	3839	3823	3806	3790	3773	3757	3	6	8	11	14
25	0·3741	3724	3708	3692	3676	3660	3644	3629	3613	3597	3	5	8	11	13
26	0·3582	3566	3551	3535	3520	3505	3490	3474	3459	3444	3	5	8	10	13
27	0·3430	3415	3400	3385	3371	3356	3341	3327	3313	3298	2	5	7	10	12
28	0·3284	3270	3256	3241	3227	3213	3199	3186	3172	3158	2	5	7	9	12
29	0·3144	3131	3117	3104	3090	3077	3063	3050	3037	3023	2	4	7	9	11
30	0·3010	2997	2984	2971	2958	2945	2932	2920	2907	2894	2	4	6	9	11
31	0·2882	2869	2856	2844	2832	2819	2807	2795	2782	2770	2	4	6	8	10
32	0·2758	2746	2734	2722	2710	2698	2686	2674	2662	2651	2	4	6	8	10
33	0·2639	2627	2616	2604	2593	2581	2570	2558	2547	2536	2	4	6	8	10
34	0·2524	2513	2502	2491	2480	2469	2458	2447	2436	2425	2	4	6	7	9
35	0·2414	2403	2393	2382	2371	2360	2350	2339	2329	2318	2	4	5	7	9
36	0·2308	2297	2287	2277	2266	2256	2246	2236	2226	2215	2	3	5	7	9
37	0·2205	2195	2185	2175	2165	2156	2146	2136	2126	2116	2	3	5	7	8
38	0·2107	2097	2087	2078	2068	2059	2049	2040	2030	2021	2	3	5	6	8
39	0·2011	2002	1993	1983	1974	1965	1956	1947	1937	1928	2	3	5	6	8
40	0·1919	1910	1901	1892	1883	1875	1866	1857	1848	1839	1	3	4	6	7
41	0·1831	1822	1813	1805	1796	1787	1779	1770	1762	1753	1	3	4	6	7
42	0·1745	1736	1728	1720	1711	1703	1695	1687	1678	1670	1	3	4	6	7
43	0·1662	1654	1646	1638	1630	1622	1614	1606	1598	1590	1	3	4	5	7
44	0·1582	1574	1567	1559	1551	1543	1536	1528	1520	1513	1	3	4	5	6
°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

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	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	0·1505	1498	1490	1483	1475	1468	1460	1453	1445	1438	1	2	4	5	6
46	0·1431	1423	1416	1409	1402	1394	1387	1380	1373	1366	1	2	4	5	6
47	0·1359	1352	1345	1338	1331	1324	1317	1310	1303	1296	1	2	3	5	6
48	0·1289	1282	1276	1269	1262	1255	1249	1242	1235	1229	1	2	3	4	6
49	0·1222	1216	1209	1203	1196	1190	1183	1177	1170	1164	1	2	3	4	5
50	0·1157	1151	1145	1138	1132	1126	1120	1113	1107	1101	1	2	3	4	5
51	0·1095	1089	1083	1077	1071	1065	1059	1053	1047	1041	1	2	3	4	5
52	0·1035	1029	1023	1017	1011	1005	1000	0994	0988	0982	1	2	3	4	5
53	0·0977	0971	0965	0959	0954	0948	0943	0937	0931	0926	1	2	3	4	5
54	0·0920	0915	0909	0904	0899	0893	0888	0882	0877	0872	1	2	3	4	5
55	0·0866	0861	0856	0851	0845	0840	0835	0830	0825	0819	1	2	3	3	4
56	0·0814	0809	0804	0799	0794	0789	0784	0779	0774	0769	1	2	3	3	4
57	0·0764	0759	0754	0749	0745	0740	0735	0730	0725	0721	1	2	2	3	4
58	0·0716	0711	0706	0702	0697	0692	0688	0683	0678	0674	1	2	2	3	4
59	0·0669	0665	0660	0656	0651	0647	0642	0638	0633	0629	1	1	2	3	4
60	0·0625	0620	0616	0612	0607	0603	0599	0594	0590	0586	1	1	2	3	4
61	0·0582	0578	0573	0569	0565	0561	0557	0553	0549	0545	1	1	2	3	3
62	0·0541	0537	0533	0529	0525	0521	0517	0513	0509	0505	1	1	2	3	3
63	0·0501	0497	0494	0490	0486	0482	0478	0475	0471	0467	1	1	2	3	3
64	0·0463	0460	0456	0452	0449	0445	0442	0438	0434	0431	1	1	2	2	3
65	0·0427	0424	0420	0417	0413	0410	0406	0403	0399	0396	1	1	2	2	3
66	0·0393	0389	0386	0383	0379	0376	0373	0369	0366	0363	1	1	2	2	3
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

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	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67	0·0360	0357	0353	0350	0347	0344	0341	0338	0334	0331	1	1	2	2	3
68	0·0328	0325	0322	0319	0316	0313	0310	0307	0304	0301	0	1	1	2	2
69	0·0298	0296	0293	0290	0287	0284	0281	0278	0276	0273	0	1	1	2	2
70	0·0270	0267	0265	0262	0259	0257	0254	0251	0249	0246	0	1	1	2	2
71	0·0243	0241	0238	0236	0233	0230	0228	0225	0223	0220	0	1	1	2	2
72	0·0218	0215	0213	0211	0208	0206	0203	0201	0199	0196	0	1	1	2	2
73	0·0194	0192	0189	0187	0185	0183	0180	0178	0176	0174	0	1	1	1	2
74	0·0172	0169	0167	0165	0163	0161	0159	0157	0155	0153	0	1	1	1	2
75	0·0151	0149	0147	0145	0143	0141	0139	0137	0135	0133	0	1	1	1	2
76	0·0131	0129	0127	0125	0124	0122	0120	0118	0116	0115	0	1	1	1	2
77	0·0113	0111	0109	0108	0106	0104	0103	0101	0099	0098	0	1	1	1	1
78	0·0096	0094	0093	0091	0090	0088	0087	0085	0084	0082	0	1	1	1	1
79	0·0081	0079	0078	0076	0075	0073	0072	0071	0069	0068	0	0	1	1	1
80	0·0066	0065	0064	0063	0061	0060	0059	0057	0056	0055	0	1	1	1	1
81	0·0054	0053	0051	0050	0049	0048	0047	0046	0045	0044	0	1	1	1	1
82	0·0042	0041	0040	0039	0038	0037	0036	0035	0034	0033	0	1	1	1	1
83	0·0032	0032	0031	0030	0029	0028	0027	0026	0025	0025	0	0	1	1	1
84	0·0024	0023	0022	0022	0021	0020	0019	0019	0018	0017	0	0	0	1	1
85	0·0017	0016	0015	0015	0014	0013	0013	0012	0012	0011	0	0	1	1	1
86	0·0011	0010	0010	0009	0009	0008	0008	0007	0007	0006	0	0	1	1	1
87	0·0006	0006	0005	0005	0004	0004	0004	0004	0003	0003	0	0	0	1	1
88	0·0003	0002	0002	0002	0002	0001	0001	0001	0001	0001	0	0	0	0	0
89	0·0001	0001	0000	0000	0000	0000	0000	0000	0000	0000	0	0	0	0	0
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

NATURAL SINES

°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	·0000	0017	0035	0052	0070	0087	0105	0122	0140	0157	3	6	9	12	15
1	·0175	0192	0209	0227	0244	0262	0279	0297	0314	0332	3	6	9	12	15
2	·0349	0366	0384	0401	0419	0436	0454	0471	0488	0506	3	6	9	12	15
3	·0523	0541	0558	0576	0593	0610	0628	0645	0663	0680	3	6	9	12	15
4	·0698	0715	0732	0750	0767	0785	0802	0819	0837	0854	3	6	9	12	14
5	·0872	0889	0906	0924	0941	0958	0976	0993	1011	1028	3	6	9	12	14
6	·1045	1063	1080	1097	1115	1132	1149	1167	1184	1201	3	6	9	12	14
7	·1219	1236	1253	1271	1288	1305	1323	1340	1357	1374	3	6	9	12	14
8	·1392	1409	1426	1444	1461	1478	1495	1513	1530	1547	3	6	9	12	14
9	·1564	1582	1599	1616	1633	1650	1668	1685	1702	1719	3	6	9	11	14
10	·1736	1754	1771	1788	1805	1822	1840	1857	1874	1891	3	6	9	11	14
11	·1908	1925	1942	1959	1977	1994	2011	2028	2045	2062	3	6	9	11	14
12	·2079	2096	2113	2130	2147	2164	2181	2198	2215	2233	3	6	9	11	14
13	·2250	2267	2284	2300	2317	2334	2351	2368	2385	2402	3	6	8	11	14
14	·2419	2436	2453	2470	2487	2504	2521	2538	2554	2571	3	6	8	11	14
15	·2588	2605	2622	2639	2656	2672	2689	2706	2723	2740	3	6	8	11	14
16	·2756	2773	2790	2807	2823	2840	2857	2874	2890	2907	3	6	8	11	14
17	·2924	2940	2957	2974	2990	3007	3024	3040	3057	3074	3	6	8	11	14
18	·3090	3107	3123	3140	3156	3173	3190	3206	3223	3239	3	5	8	11	14
19	·3256	3272	3289	3305	3322	3338	3355	3371	3387	3404	3	5	8	11	14
20	·3420	3437	3453	3469	3486	3502	3518	3535	3551	3567	3	5	8	11	14
21	·3584	3600	3616	3633	3649	3665	3681	3697	3714	3730	3	5	8	11	14
22	·3746	3762	3778	3795	3811	3827	3843	3859	3875	3891	3	5	8	11	13
23	·3907	3923	3939	3955	3971	3987	4003	4019	4035	4051	3	5	8	11	13
24	·4067	4083	4099	4115	4131	4147	4163	4179	4195	4210	3	5	8	11	13
25	·4226	4242	4258	4274	4289	4305	4321	4337	4352	4368	3	5	8	11	13
26	·4384	4399	4415	4431	4446	4462	4478	4493	4509	4524	3	5	8	10	13
27	·4540	4555	4571	4586	4602	4617	4633	4648	4664	4679	3	5	8	10	13
28	·4695	4710	4726	4741	4756	4772	4787	4802	4818	4833	3	5	8	10	13
29	·4848	4863	4879	4894	4909	4924	4939	4955	4970	4985	3	5	8	10	13
30	·5000	5015	5030	5045	5060	5075	5090	5105	5120	5135	3	5	8	10	13
31	·5150	5165	5180	5195	5210	5225	5240	5255	5270	5284	2	5	7	10	12
32	·5299	5314	5329	5344	5358	5373	5388	5402	5417	5432	2	5	7	10	12
33	·5446	5461	5476	5490	5505	5519	5534	5548	5563	5577	2	5	7	10	12
34	·5592	5606	5621	5635	5650	5664	5678	5693	5707	5721	2	5	7	10	12
35	·5736	5750	5764	5779	5793	5807	5821	5835	5850	5864	2	5	7	9	12
36	·5878	5892	5906	5920	5934	5948	5962	5976	5990	6004	2	5	7	9	12
37	·6018	6032	6046	6060	6074	6088	6101	6115	6129	6143	2	5	7	9	12
38	·6157	6170	6184	6198	6211	6225	6239	6252	6266	6280	2	5	7	9	11
39	·6293	6307	6320	6334	6347	6361	6374	6388	6401	6414	2	4	7	9	11
40	·6428	6441	6455	6468	6481	6494	6508	6521	6534	6547	2	4	7	9	11
41	·6561	6574	6587	6600	6613	6626	6639	6652	6665	6678	2	4	7	9	11
42	·6691	6704	6717	6730	6743	6756	6769	6782	6794	6807	2	4	6	9	11
43	·6820	6833	6845	6858	6871	6884	6896	6909	6921	6934	2	4	6	8	11
44	·6947	6959	6972	6984	6997	7009	7022	7034	7046	7059	2	4	6	8	10

NATURAL SINES

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	.7071	7083	7096	7108	7120	7133	7145	7157	7169	7181	2	4	6	8	10
46	.7193	7206	7218	7230	7242	7254	7266	7278	7290	7302	2	4	6	8	10
47	.7314	7325	7337	7349	7361	7373	7385	7396	7408	7420	2	4	6	8	10
48	.7431	7443	7455	7466	7478	7490	7501	7513	7524	7536	2	4	6	8	10
49	.7547	7559	7570	7581	7593	7604	7615	7627	7638	7649	2	4	6	8	10
50	.7660	7672	7683	7694	7705	7716	7727	7738	7749	7760	2	4	6	7	9
51	.7771	7782	7793	7804	7815	7826	7837	7848	7859	7869	2	4	5	7	9
52	.7880	7891	7902	7912	7923	7934	7944	7955	7965	7976	2	4	5	7	9
53	.7986	7997	8007	8018	8028	8039	8049	8059	8070	8080	2	4	5	7	9
54	.8090	8100	8111	8121	8131	8141	8151	8161	8171	8181	2	3	5	7	9
55	.8192	8202	8211	8221	8231	8241	8251	8261	8271	8281	2	3	5	7	8
56	.8290	8300	8310	8320	8329	8339	8348	8358	8368	8377	2	3	5	7	8
57	.8387	8396	8406	8415	8425	8434	8443	8453	8462	8471	2	3	5	6	8
58	.8480	8490	8499	8508	8517	8526	8536	8545	8554	8563	2	3	5	6	8
59	.8572	8581	8590	8599	8607	8616	8625	8634	8643	8652	1	3	4	6	7
60	.8660	8669	8678	8686	8695	8704	8712	8721	8729	8738	1	3	4	6	7
61	.8746	8755	8763	8771	8780	8788	8796	8805	8813	8821	1	3	4	6	7
62	.8829	8838	8846	8854	8862	8870	8878	8886	8894	8902	1	3	4	5	7
63	.8910	8918	8926	8934	8942	8949	8957	8965	8973	8980	1	3	4	5	7
64	.8988	8996	9003	9011	9018	9026	9033	9041	9048	9056	1	3	4	5	6
65	.9063	9070	9078	9085	9092	9100	9107	9114	9121	9128	1	2	4	5	6
66	.9135	9143	9150	9157	9164	9171	9178	9184	9191	9198	1	2	4	5	6
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67°	.9205	9212	9219	9225	9232	9239	9245	9252	9259	9265	1	2	3	5	6
68	.9272	9278	9285	9291	9298	9304	9311	9317	9323	9330	1	2	3	4	5
69	.9336	9342	9348	9354	9361	9367	9373	9379	9385	9391	1	2	3	4	5
70	.9397	9403	9409	9415	9421	9426	9432	9438	9444	9449	1	2	3	4	5
71	.9455	9461	9466	9472	9478	9483	9489	9494	9500	9505	1	2	3	4	5
72	.9511	9516	9521	9527	9532	9537	9542	9548	9553	9558	1	2	3	4	4
73	.9563	9568	9573	9578	9583	9588	9593	9598	9603	9608	1	2	3	3	4
74	.9613	9617	9622	9627	9632	9636	9641	9646	9650	9655	1	2	2	3	4
75	.9659	9664	9668	9673	9677	9681	9686	9690	9694	9699	1	2	2	3	4
76	.9703	9707	9711	9715	9720	9724	9728	9732	9736	9740	1	1	2	3	4
77	.9744	9748	9751	9755	9759	9763	9767	9770	9774	9778	1	1	2	3	3
78	.9781	9785	9789	9792	9796	9799	9803	9806	9810	9813	1	1	2	2	3
79	.9816	9820	9823	9826	9829	9833	9836	9839	9842	9845	1	1	2	2	3
80	.9848	9851	9854	9857	9860	9863	9866	9869	9871	9874	1	1	2	2	3
81	.9877	9880	9882	9885	9888	9890	9893	9895	9898	9900	0	1	1	2	2
82	.9903	9905	9907	9910	9912	9914	9917	9919	9921	9923	0	1	1	2	2
83	.9925	9928	9930	9932	9934	9936	9938	9940	9942	9943	0	1	1	1	2
84	.9945	9947	9949	9951	9952	9954	9956	9957	9959	9960	0	1	1	1	2
85	.9962	9963	9965	9966	9968	9969	9971	9972	9973	9974	0	1	1	1	1
86	.9976	9977	9978	9979	9980	9981	9982	9983	9984	9985	0	0	1	1	1
87	.9986	9987	9988	9989	9990	9990	9991	9992	9993	9993	0	0	0	1	1
88	.9994	9995	9995	9996	9996	9997	9997	9997	9998	9998	0	0	0	0	1
89	.9998	9999	9999	9999	9999	1·000	1·000	1·000	1·000	1·000	0	0	0	0	0

NATURAL COSINES

SUBTRACT

deg	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0°	1·0000	1·000	1·000	1·000	1·000	1·000	9999	9999	9999	9999					
1	·9998	9998	9998	9997	9997	9997	9996	9996	9995	9995					
2	·9994	9993	9993	9992	9991	9990	9990	9989	9988	9987	0	0	0	0	1
3	·9986	9985	9984	9983	9982	9981	9980	9979	9978	9977	0	0	1	1	1
4	·9976	9974	9973	9972	9971	9969	9968	9966	9965	9963	0	0	1	1	1
5	·9962	9960	9959	9957	9956	9954	9952	9951	9949	9947	0	1	1	1	1
6	·9945	9943	9942	9940	9938	9936	9934	9932	9930	9928	0	1	1	1	2
7	·9925	9923	9921	9919	9917	9914	9912	9910	9907	9905	0	1	1	2	2
8	·9903	9900	9898	9895	9893	9890	9888	9885	9882	9880	0	1	1	2	2
9	·9877	9874	9871	9869	9866	9863	9860	9857	9854	9851	0	1	1	2	2
10	·9848	9845	9842	9839	9836	9833	9829	9826	9823	9820	1	1	2	2	3
11	·9816	9813	9810	9806	9803	9799	9796	9792	9789	9785	1	1	2	2	3
12	·9781	9778	9774	9770	9767	9763	9759	9755	9751	9748	1	1	2	3	3
13	·9744	9740	9736	9732	9728	9724	9720	9715	9711	9707	1	1	2	3	3
14	·9703	9699	9694	9690	9686	9681	9677	9673	9668	9664	1	1	2	3	4
15	·9659	9655	9650	9646	9641	9636	9632	9627	9622	9617	1	1	2	3	4
16	·9613	9608	9603	9598	9593	9588	9583	9578	9573	9568	1	1	2	3	4
17	·9563	9558	9553	9548	9542	9537	9532	9527	9521	9516	1	2	3	4	4
18	·9511	9505	9500	9494	9489	9483	9478	9472	9466	9461	1	2	3	4	5
19	·9455	9449	9444	9438	9432	9426	9421	9415	9409	9403	1	2	3	4	5
20	·9397	9391	9385	9379	9373	9367	9361	9354	9348	9342	1	2	3	4	5
21	·9336	9330	9323	9317	9311	9304	9298	9291	9285	9278	1	2	3	4	5
22	·9272	9265	9259	9252	9245	9239	9232	9225	9219	9212	1	2	3	4	6
23	·9205	9198	9191	9184	9178	9171	9164	9157	9150	9143	1	2	3	5	6
24	·9135	9128	9121	9114	9107	9100	9092	9085	9078	9070	1	2	4	5	6
25	·9063	9056	9048	9041	9033	9026	9018	9011	9003	8996	1	3	4	5	6
26	·8988	8980	8973	8965	8957	8949	8942	8934	8926	8918	1	3	4	5	7
27	·8910	8902	8894	8886	8878	8870	8862	8854	8846	8838	1	3	4	6	7
28	·8829	8821	8813	8805	8796	8788	8780	8771	8763	8755	1	3	4	6	7
29	·8746	8738	8729	8721	8712	8704	8695	8686	8678	8669	1	3	4	6	7
30	·8660	8652	8643	8634	8625	8616	8607	8599	8590	8581	1	3	4	6	7
31	·8572	8563	8554	8545	8536	8526	8517	8508	8499	8490	2	3	5	6	8
32	·8480	8471	8462	8453	8443	8434	8425	8415	8406	8396	2	3	5	6	8
33	·8387	8377	8368	8358	8348	8339	8329	8320	8310	8300	2	3	5	6	8
34	·8290	8281	8271	8261	8251	8241	8231	8221	8211	8202	2	3	5	7	8
35	·8192	8181	8171	8161	8151	8141	8131	8121	8111	8100	2	3	5	7	8
36	·8090	8080	8070	8059	8049	8039	8028	8018	8007	7997	2	3	5	7	9
37	·7986	7976	7965	7955	7944	7934	7923	7912	7902	7891	2	4	5	7	9
38	·7880	7869	7859	7848	7837	7826	7815	7804	7793	7782	2	4	5	7	9
39	·7771	7760	7749	7738	7727	7716	7705	7694	7683	7672	2	4	6	7	9
40	·7660	7649	7638	7627	7615	7604	7593	7581	7570	7559	2	4	6	8	9
41	·7547	7536	7524	7513	7501	7490	7478	7466	7455	7443	2	4	6	8	10
42	·7431	7420	7408	7396	7385	7373	7361	7349	7337	7325	2	4	6	8	10
43	·7314	7302	7290	7278	7266	7254	7242	7230	7218	7206	2	4	6	8	10
44	·7193	7181	7169	7157	7145	7133	7120	7108	7096	7083	2	4	6	8	10

The black type indicates that the integer changes.

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	.7071	7059	7046	7034	7022	7009	6997	6984	6972	6959	2	4	6	8	10
46	.6947	6934	6921	6909	6896	6884	6871	6858	6845	6833	2	4	6	8	11
47	.6820	6807	6794	6782	6769	6756	6743	6730	6717	6704	2	4	6	9	11
48	.6691	6678	6665	6652	6639	6626	6613	6600	6587	6574	2	4	7	9	11
49	.6561	6547	6534	6521	6508	6494	6481	6468	6455	6441	2	4	7	9	11
50	.6428	6414	6401	6388	6374	6361	6347	6334	6320	6307	2	4	7	9	11
51	.6293	6280	6266	6252	6239	6225	6211	6198	6184	6170	2	5	7	9	11
52	.6157	6143	6129	6115	6101	6088	6074	6060	6046	6032	2	5	7	9	12
53	.6018	6004	5990	5976	5962	5948	5934	5920	5906	5892	2	5	7	9	12
54	.5878	5864	5850	5835	5821	5807	5793	5779	5764	5750	2	5	7	9	12
55	.5736	5721	5707	5693	5678	5664	5650	5635	5621	5606	2	5	7	10	12
56	.5592	5577	5563	5548	5534	5519	5505	5490	5476	5461	2	5	7	10	12
57	.5446	5432	5417	5402	5388	5373	5358	5344	5329	5314	2	5	7	10	12
58	.5299	5284	5270	5255	5240	5225	5210	5195	5180	5165	3	5	7	10	12
59	.5150	5135	5120	5105	5090	5075	5060	5045	5030	5015	3	5	8	10	13
60	.5000	4985	4970	4955	4939	4924	4909	4894	4879	4863	3	5	8	10	13
61	.4848	4833	4818	4802	4787	4772	4756	4741	4726	4710	3	5	8	10	13
62	.4695	4679	4664	4648	4633	4617	4602	4586	4571	4555	3	5	8	10	13
63	.4540	4524	4509	4493	4478	4462	4446	4431	4415	4399	3	5	8	10	13
64	.4384	4368	4352	4337	4321	4305	4289	4274	4258	4242	3	5	8	11	13
65	.4226	4210	4195	4179	4163	4147	4131	4115	4099	4083	3	5	8	11	13
66	.4067	4051	4035	4019	4003	3987	3971	3955	3939	3923	3	5	8	11	13
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67	.3907	3891	3875	3859	3843	3827	3811	3795	3778	3762	3	5	8	11	13
68	.3746	3730	3714	3697	3681	3665	3649	3633	3616	3600	3	5	8	11	14
69	.3584	3567	3551	3535	3518	3502	3486	3469	3453	3437	3	5	8	11	14
70	.3420	3404	3387	3371	3355	3338	3322	3305	3289	3272	3	5	8	11	14
71	.3256	3239	3223	3206	3190	3173	3156	3140	3123	3107	3	6	8	11	14
72	.3090	3074	3057	3040	3024	3007	2990	2974	2957	2940	3	6	8	11	14
73	.2924	2907	2890	2874	2857	2840	2823	2807	2790	2773	3	6	8	11	14
74	.2756	2740	2723	2706	2689	2672	2656	2639	2622	2605	3	6	8	11	14
75	.2588	2571	2554	2538	2521	2504	2487	2470	2453	2436	3	6	8	11	14
76	.2419	2402	2385	2368	2351	2334	2317	2300	2284	2267	3	6	8	11	14
77	.2250	2233	2215	2198	2181	2164	2147	2130	2113	2096	3	6	9	11	14
78	.2079	2062	2045	2028	2011	1994	1977	1959	1942	1925	3	6	9	11	14
79	.1908	1891	1874	1857	1840	1822	1805	1788	1771	1754	3	6	9	11	14
80	.1736	1719	1702	1685	1668	1650	1633	1616	1599	1582	3	6	9	11	14
81	.1564	1547	1530	1513	1495	1478	1461	1444	1426	1409	3	6	9	12	14
82	.1392	1374	1357	1340	1323	1305	1288	1271	1253	1236	3	6	9	12	14
83	.1219	1201	1184	1167	1149	1132	1115	1097	1080	1063	3	6	9	12	14
84	.1045	1028	1011	0993	0976	0958	0941	0924	0906	0889	3	6	9	12	14
85	.0872	0854	0837	0819	0802	0785	0767	0750	0732	0715	3	6	9	12	14
86	.0698	0680	0663	0645	0628	0610	0593	0576	0558	0541	3	6	9	12	15
87	.0523	0506	0488	0471	0454	0436	0419	0401	0384	0366	3	6	9	12	15
88	.0349	0332	0314	0297	0279	0262	0244	0227	0209	0192	3	6	9	12	15
89	.0175	0157	0140	0122	0105	0087	0070	0052	0035	0017	3	6	9	12	15
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

NATURAL TANGENTS

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0°	0·0000	0017	0035	0052	0070	0087	0105	0122	0140	0157	3	6	9	12	15
1	0·0175	0192	0209	0227	0244	0262	0279	0297	0314	0332	3	6	9	12	15
2	0·0349	0367	0384	0402	0419	0437	0454	0472	0489	0507	3	6	9	12	15
3	0·0524	0542	0559	0577	0594	0612	0629	0647	0664	0682	3	6	9	12	15
4	0·0699	0717	0734	0752	0769	0787	0805	0822	0840	0857	3	6	9	12	15
5	0·0875	0892	0910	0928	0945	0963	0981	0998	1016	1033	3	6	9	12	15
6	0·1051	1069	1086	1104	1122	1139	1157	1175	1192	1210	3	6	9	12	15
7	0·1228	1246	1263	1281	1299	1317	1334	1352	1370	1388	3	6	9	12	15
8	0·1405	1423	1441	1459	1477	1495	1512	1530	1548	1566	3	6	9	12	15
9	0·1584	1602	1620	1638	1655	1673	1691	1709	1727	1745	3	6	9	12	16
10	0·1763	1781	1799	1817	1835	1853	1871	1890	1908	1926	3	6	9	12	15
11	0·1944	1962	1980	1998	2016	2035	2053	2071	2089	2107	3	6	9	12	15
12	0·2126	2144	2162	2180	2199	2217	2235	2254	2272	2290	3	6	9	12	15
13	0·2309	2327	2345	2364	2382	2401	2419	2438	2456	2475	3	6	9	12	15
14	0·2493	2512	2530	2549	2568	2586	2605	2623	2642	2661	3	6	9	12	16
15	0·2679	2698	2717	2736	2754	2773	2792	2811	2830	2849	3	6	9	13	16
16	0·2867	2886	2905	2924	2943	2962	2981	3000	3019	3038	3	6	9	13	16
17	0·3057	3076	3096	3115	3134	3153	3172	3191	3211	3230	3	6	9	13	16
18	0·3249	3269	3288	3307	3327	3346	3365	3385	3404	3424	3	6	10	13	16
19	0·3443	3463	3482	3502	3522	3541	3561	3581	3600	3620	3	7	10	13	16
20	0·3640	3659	3679	3699	3719	3739	3759	3779	3799	3819	3	7	10	13	17
21	0·3839	3859	3879	3899	3919	3939	3959	3979	4000	4020	3	7	10	13	17
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
22	0·4040	4061	4081	4101	4122	4142	4163	4183	4204	4224	3	7	10	14	17
23	0·4245	4265	4286	4307	4327	4348	4369	4390	4411	4431	3	7	10	14	17
24	0·4452	4473	4494	4515	4536	4557	4578	4599	4621	4642	4	7	11	14	18
25	0·4663	4684	4706	4727	4748	4770	4791	4813	4834	4856	4	7	11	14	18
26	0·4877	4899	4921	4942	4964	4986	5008	5029	5051	5073	4	7	11	15	18
27	0·5095	5117	5139	5161	5184	5206	5228	5250	5272	5295	4	7	11	15	18
28	0·5317	5340	5362	5384	5407	5430	5452	5475	5498	5520	4	8	11	15	19
29	0·5543	5566	5589	5612	5635	5658	5681	5704	5727	5750	4	8	12	15	19
30	0·5774	5797	5820	5844	5867	5890	5914	5938	5961	5985	4	8	12	16	20
31	0·6009	6032	6056	6080	6104	6128	6152	6176	6200	6224	4	8	12	16	20
32	0·6249	6273	6297	6322	6346	6371	6395	6420	6445	6469	4	8	12	16	20
33	0·6494	6519	6544	6569	6594	6619	6644	6669	6694	6720	4	8	13	17	21
34	0·6745	6771	6796	6822	6847	6873	6899	6924	6950	6976	4	9	13	17	21
35	0·7002	7028	7054	7080	7107	7133	7159	7186	7212	7239	4	9	13	18	22
36	0·7265	7292	7319	7346	7373	7400	7427	7454	7481	7508	5	9	14	18	23
37	0·7536	7563	7590	7618	7646	7673	7701	7729	7757	7785	5	9	14	18	23
38	0·7813	7841	7869	7898	7926	7954	7983	8012	8040	8069	5	9	14	19	24
39	0·8098	8127	8156	8185	8214	8243	8273	8302	8332	8361	5	10	15	20	24
40	0·8391	8421	8451	8481	8511	8541	8571	8601	8632	8662	5	10	15	20	25
41	0·8693	8724	8754	8785	8816	8847	8878	8910	8941	8972	5	10	16	21	26
42	0·9004	9036	9067	9099	9131	9163	9195	9228	9260	9293	5	11	16	21	27
43	0·9325	9358	9391	9424	9457	9490	9523	9556	9590	9623	6	11	17	22	28
44	0·9657	9691	9725	9759	9793	9827	9861	9896	9930	9965	6	11	17	23	29
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	1·0000	0035	0070	0105	0141	0176	0212	0247	0283	0319	6	12	18	24	30
46	1·0355	0392	0428	0464	0501	0538	0575	0612	0649	0686	6	12	18	25	31
47	1·0724	0761	0799	0837	0875	0913	0951	0990	1028	1067	6	13	19	25	32
48	1·1106	1145	1184	1224	1263	1303	1343	1383	1423	1463	7	13	20	26	33
49	1·1504	1544	1585	1626	1667	1708	1750	1792	1833	1875	7	14	21	28	34
50	1·1918	1960	2002	2045	2088	2131	2174	2218	2261	2305	7	14	22	29	36
51	1·2349	2393	2437	2482	2527	2572	2617	2662	2708	2753	8	15	23	30	38
52	1·2799	2846	2892	2938	2985	3032	3079	3127	3175	3222	8	16	24	31	39
53	1·3270	3314	3367	3416	3465	3514	3564	3613	3663	3713	8	16	25	33	41
54	1·3764	3814	3865	3916	3968	4019	4071	4124	4176	4229	9	17	26	34	43
55	1·4281	4335	4388	4442	4496	4550	4605	4659	4715	4770	9	18	27	36	45
56	1·4826	4882	4938	4994	5051	5108	5166	5224	5282	5340	10	19	29	38	48
57	1·5399	5458	5517	5577	5637	5697	5757	5818	5880	5941	10	20	30	40	50
58	1·6003	6066	6128	6191	6255	6319	6383	6447	6512	6577	11	21	32	43	53
59	1·6643	6709	6775	6842	6909	6977	7045	7113	7182	7251	11	23	34	45	56
60	1·7321	7391	7461	7532	7603	7675	7747	7820	7893	7966	12	24	36	48	60
61	1·8040	8115	8190	8265	8341	8418	8495	8572	8650	8728	13	26	38	51	64
62	1·8807	8887	8967	9047	9128	9210	9292	9375	9458	9542	14	27	41	55	68
63	1·9626	9711	9797	9883	9970	0057	0145	0233	0323	0413	15	29	44	58	73
64	2·0503	0594	0686	0778	0872	0965	1060	1155	1251	1348	16	31	47	63	78
65	2·1445	1543	1642	1742	1842	1943	2045	2148	2251	2355	17	34	51	68	85
66	2·2460	2566	2673	2781	2889	2998	3109	3220	3332	3445	18	37	55	73	91

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67	2·3559	3673	3789	3906	4023	4142	4262	4383	4504	4627	20	40	60	79	99
68	2·4751	4876	5002	5129	5257	5386	5517	5649	5782	5916	22	43	65	87	108
69	2·6051	6187	6325	6464	6605	6746	6889	7034	7179	7326	24	47	71	95	119
70	2·7475	7625	7776	7929	8083	8239	8397	8556	8716	8878	26	52	78	104	130
71	2·9042	9208	9375	9544	9714	9887	0061	0237	0415	0595	29	58	87	116	144
72	3·0777	0961	1146	1334	1524	1716	1910	2106	2305	2506	32	64	97	129	161
73	3·2709	2914	3122	3332	3544	3759	3977	4197	4420	4646	36	72	108	144	180
74	3·4874	5105	5339	5576	5816	6059	6305	6554	6806	7062	41	81	122	163	203
75	3·7321	7583	7848	8118	8391	8667	8947	9232	9520	9812	46	93	139	186	232
76	4·0108	0408	0713	1022	1335	1653	1976	2303	2635	2972	53	107	160	214	267
77	4·3315	3662	4015	4373	4737	5107	5483	5864	6252	6646	62	124	186	248	310
78	4·7046	7453	7867	8288	8716	9152	9594	0045	0504	0970	73	146	220	293	366
79	5·1446	1929	2422	2924	3435	3955	4486	5026	5578	6140	87	175	263	350	438
80	5·671	5·730	5·789	5·850	5·912	5·976	6·041	6·107	6·174	6·243					
81	6·314	6·386	6·460	6·535	6·612	6·691	6·772	6·855	6·940	7·026					
82	7·115	7·207	7·300	7·396	7·495	7·596	7·700	7·806	7·916	8·028					
83	8·144	8·264	8·386	8·513	8·643	8·777	8·915	9·058	9·205	9·357	Differences untrustworthy here				
84	9·51	9·68	9·84	10·02	10·20	10·39	10·58	10·78	10·99	11·20					
85	11·43	11·66	11·91	12·16	12·43	12·71	13·00	13·30	13·62	13·95					
86	14·30	14·67	15·06	15·46	15·89	16·35	16·83	17·34	17·89	18·46					
87	19·08	19·74	20·45	21·20	22·02	22·90	23·86	24·90	26·03	27·27					
88	28·64	30·14	31·82	33·69	35·80	38·19	40·92	44·07	47·74	52·08					
89	57·29	63·66	71·62	81·85	95·49	114·6	143·2	191·0	286·5	573·0					

The black type indicates that the integer changes.

°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	∞				Differences untrustworthy here										
1	57·29	52·08	47·74	44·07	40·92	38·19	35·80	33·69	31·82	30·14					
2	28·64	27·27	26·03	24·90	23·86	22·90	22·02	21·20	20·45	19·74					
3	19·08	18·46	17·89	17·34	16·83	16·35	15·89	15·46	15·06	14·67					
4	14·30	13·95	13·62	13·30	13·00	12·71	12·43	12·16	11·91	11·66					
5	11·43	11·20	10·99	10·78	10·58	10·39	10·20	10·02	9·84	9·68					
6	9·514	9·357	9·205	9·058	8·915	8·777	8·643	8·513	8·386	8·264					
7	8·144	8·028	7·916	7·806	7·700	7·596	7·495	7·396	7·300	7·207					
8	7·115	7·026	6·940	6·855	6·772	6·691	6·612	6·535	6·460	6·386					
9	6·314	6·243	6·174	6·107	6·041	5·976	5·912	5·850	5·789	5·730					
10	5·6713	6140	5578	5026	4486	3955	3435	2924	2422	1929	87	175	263	350	438
11	5·1446	0970	0504	0045	9594	9152	8716	8288	7867	7453	73	146	220	293	366
12	4·7046	6646	6252	5864	5483	5107	4737	4373	4015	3662	62	124	186	248	310
13	4·4315	2972	2635	2303	1976	1653	1335	1022	0713	0408	53	107	160	214	267
14	4·0108	9812	9520	9232	8947	8667	8391	8118	7848	7583	46	93	139	186	232
15	3·7321	7062	6806	6554	6305	6059	5816	5576	5339	5105	41	81	122	163	203
16	3·4874	4646	4420	4197	3977	3759	3544	3332	3122	2914	36	72	108	144	180
17	3·2709	2506	2305	2106	1910	1716	1524	1334	1146	0961	32	64	97	129	161
18	3·0777	0595	0415	0237	0061	9887	9714	9544	9375	9208	29	58	87	116	144
19	2·9042	8878	8716	8556	8397	8239	8083	7929	7776	7625	26	52	78	104	130
20	2·7475	7326	7179	7034	6889	6746	6605	6464	6325	6187	24	47	71	95	119
21	2·6051	5916	5782	5649	5517	5386	5257	5129	5002	4876	22	43	65	87	108
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
22	2·4751	4627	4504	4383	4262	4142	4023	3906	3789	3673	20	40	60	79	99
23	2·3559	3445	3332	3220	3109	2998	2889	2781	2673	2566	18	37	55	73	91
24	2·2460	2355	2251	2148	2045	1943	1842	1742	1642	1543	17	34	51	68	85
25	2·1445	1348	1251	1155	1060	0965	0872	0778	0686	0594	16	31	47	63	78
26	2·0503	0413	0323	0233	0145	0057	9970	9883	9797	9711	15	29	44	58	73
27	1·9626	9542	9458	9375	9292	9210	9128	9047	8967	8887	14	27	41	55	68
28	1·8807	8728	8650	8572	8495	8418	8341	8265	8190	8115	13	26	38	51	64
29	1·8040	7966	7893	7820	7747	7675	7603	7532	7461	7391	12	24	36	48	60
30	1·7321	7251	7182	7113	7045	6977	6909	6842	6775	6709	11	23	34	45	56
31	1·6643	6577	6512	6447	6383	6319	6255	6191	6128	6066	11	21	32	43	53
32	1·6003	5941	5880	5818	5757	5697	5637	5577	5517	5458	10	20	30	40	50
33	1·5399	5340	5282	5224	5166	5108	5051	4994	4938	4882	10	19	29	38	48
34	1·4826	4770	4715	4659	4605	4550	4496	4442	4388	4335	9	18	27	36	45
35	1·4281	4229	4176	4124	4071	4019	3968	3916	3865	3814	9	17	26	34	43
36	1·3764	3713	3663	3613	3564	3514	3465	3416	3367	3319	8	16	25	33	41
37	1·3270	3222	3175	3127	3079	3032	2985	2938	2892	2846	8	16	24	31	39
38	1·2799	2753	2708	2662	2617	2572	2527	2482	2437	2393	8	15	23	30	38
39	1·2349	2305	2261	2218	2174	2131	2088	2045	2002	1960	7	14	22	29	36
40	1·1918	1875	1833	1792	1750	1708	1667	1626	1585	1544	7	14	21	28	34
41	1·1504	1463	1423	1383	1343	1303	1263	1224	1184	1145	7	13	20	26	33
42	1·1106	1067	1028	0990	0951	0913	0875	0837	0799	0761	6	13	19	25	32
43	1·0724	0686	0649	0612	0575	0538	0501	0464	0428	0392	6	12	18	25	31
44	1·0355	0319	0283	0247	0212	0176	0141	0105	0070	0035	6	12	18	24	30
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	1·0000	9965	9930	9896	9861	9827	9793	9759	9725	9691	6	11	17	23	29
46	0·9657	9623	9590	9556	9523	9490	9457	9424	9391	9358	6	11	17	22	28
47	0·9325	9293	9260	9228	9195	9163	9131	9099	9067	9036	6	11	16	21	27
48	0·9004	8972	8941	8910	8878	8847	8816	8785	8754	8724	5	10	16	21	26
49	0·8693	8662	8632	8601	8571	8541	8511	8481	8451	8421	5	10	15	20	25
50	0·8391	8361	8332	8302	8273	8243	8214	8185	8156	8127	5	10	15	20	24
51	0·8098	8069	8040	8012	7983	7954	7926	7898	7869	7841	5	9	14	19	24
52	0·7813	7785	7757	7729	7701	7673	7646	7618	7590	7563	5	9	14	18	23
53	0·7536	7508	7481	7454	7427	7400	7373	7346	7319	7292	5	9	14	18	23
54	0·7265	7239	7212	7186	7159	7133	7107	7080	7054	7028	4	9	13	18	22
55	0·7002	6976	6950	6924	6899	6873	6847	6822	6796	6771	4	9	13	17	21
56	0·6745	6720	6694	6669	6644	6619	6594	6569	6544	6519	4	8	13	17	21
57	0·6494	6469	6445	6420	6395	6371	6346	6322	6297	6273	4	8	12	16	20
58	0·6249	6224	6200	6176	6152	6128	6104	6080	6056	6032	4	8	12	16	20
59	0·6009	5985	5961	5938	5914	5890	5867	5844	5820	5797	4	8	12	16	20
60	0·5774	5750	5727	5704	5681	5658	5635	5612	5589	5566	4	8	12	15	19
61	0·5543	5520	5498	5475	5452	5430	5407	5384	5362	5340	4	8	11	15	19
62	0·5317	5295	5272	5250	5228	5206	5184	5161	5139	5117	4	7	11	15	18
63	0·5095	5073	5051	5029	5008	4986	4964	4942	4921	4899	4	7	11	14	18
64	0·4877	4856	4834	4813	4791	4770	4748	4727	4706	4684	4	7	11	14	18
65	0·4663	4642	4621	4599	4578	4557	4536	4515	4494	4473	4	7	11	14	18
66	0·4452	4431	4411	4390	4369	4348	4327	4307	4286	4265	3	7	10	14	17
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67	0·4245	4224	4204	4183	4163	4142	4122	4101	4081	4061	3	7	10	14	17
68	0·4040	4020	4000	3979	3959	3939	3919	3899	3879	3859	3	7	10	13	17
69	0·3839	3819	3799	3779	3759	3739	3719	3699	3679	3659	3	7	10	13	17
70	0·3640	3620	3600	3581	3561	3541	3522	3502	3482	3463	3	7	10	13	16
71	0·3443	3424	3404	3385	3365	3346	3327	3307	3288	3269	3	6	10	13	16
72	0·3249	3230	3211	3191	3172	3153	3134	3115	3096	3076	3	6	10	13	16
73	0·3057	3038	3019	3000	2981	2962	2943	2924	2905	2886	3	6	9	13	16
74	0·2867	2849	2830	2811	2792	2773	2754	2736	2717	2698	3	6	9	13	16
75	0·2679	2661	2642	2623	2605	2586	2568	2549	2530	2512	3	6	9	12	16
76	0·2493	2475	2456	2438	2419	2401	2382	2364	2345	2327	3	6	9	12	15
77	0·2309	2290	2272	2254	2235	2217	2199	2180	2162	2144	3	6	9	12	15
78	0·2126	2107	2089	2071	2053	2035	2016	1998	1980	1962	3	6	9	12	15
79	0·1944	1926	1908	1890	1871	1853	1835	1817	1799	1781	3	6	9	12	15
80	0·1763	1745	1727	1709	1691	1673	1655	1638	1620	1602	3	6	9	12	15
81	0·1584	1566	1548	1530	1512	1495	1477	1459	1441	1423	3	6	9	12	15
82	0·1405	1388	1370	1352	1334	1317	1299	1281	1263	1246	3	6	9	12	15
83	0·1228	1210	1192	1175	1157	1139	1122	1104	1086	1069	3	6	9	12	15
84	0·1051	1033	1016	0998	0981	0963	0945	0928	0910	0892	3	6	9	12	15
85	0·0875	0857	0840	0822	0805	0787	0769	0752	0734	0717	3	6	9	12	15
86	0·0699	0682	0664	0647	0629	0612	0594	0577	0559	0542	3	6	9	12	15
87	0·0524	0507	0489	0472	0454	0437	0419	0402	0384	0367	3	6	9	12	15
88	0·0349	0332	0314	0297	0279	0262	0244	0227	0209	0192	3	6	9	12	15
89	0·0175	0157	0140	0122	0105	0087	0070	0052	0035	0017	3	6	9	12	15
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

NATURAL SECANTS

°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0	1·0000	0000	0000	0000	0000	0000	0001	0001	0001	0001					
1	1·0002	0002	0002	0003	0003	0003	0004	0004	0005	0006					
2	1·0006	0007	0007	0008	0009	0010	0010	0011	0012	0013			0	0	1
3	1·0014	0015	0016	0017	0018	0019	0020	0021	0022	0023	0	0	0	0	1
4	1·0024	0026	0027	0028	0030	0031	0032	0034	0035	0037	0	0	1	1	1
5	1·0038	0040	0041	0043	0045	0046	0048	0050	0051	0053	0	1	1	1	1
6	1·0055	0057	0059	0061	0063	0065	0067	0069	0071	0073	0	1	1	1	2
7	1·0075	0077	0079	0082	0084	0086	0089	0091	0093	0096	0	1	1	2	2
8	1·0098	0101	0103	0106	0108	0111	0114	0116	0119	0122	0	1	1	2	2
9	1·0125	0127	0130	0133	0136	0139	0142	0145	0148	0151	1	1	1	2	2
10	1·0154	0157	0161	0164	0167	0170	0174	0177	0180	0184	1	1	2	2	3
11	1·0187	0191	0194	0198	0201	0205	0209	0212	0216	0220	1	1	2	2	3
12	1·0223	0227	0231	0235	0239	0243	0247	0251	0255	0259	1	1	2	3	3
13	1·0263	0267	0271	0276	0280	0284	0288	0293	0297	0302	1	1	2	3	4
14	1·0306	0311	0315	0320	0324	0329	0334	0338	0343	0348	1	2	2	3	4
15	1·0353	0358	0363	0367	0372	0377	0382	0388	0393	0398	1	2	3	3	4
16	1·0403	0408	0413	0419	0424	0429	0435	0440	0446	0451	1	2	3	4	4
17	1·0457	0463	0468	0474	0480	0485	0491	0497	0503	0509	1	2	3	4	5
18	1·0515	0521	0527	0533	0539	0545	0551	0557	0564	0570	1	2	3	4	5
19	1·0576	0583	0589	0595	0602	0608	0615	0622	0628	0635	1	2	3	4	5
20	1·0642	0649	0655	0662	0669	0676	0683	0690	0697	0704	1	2	3	5	6
21	1·0711	0719	0726	0733	0740	0748	0755	0763	0770	0778	1	2	4	5	6

°	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
22	1·0785	0793	0801	0808	0816	0824	0832	0840	0848	0856	1	3	4	5	7
23	1·0864	0872	0880	0888	0896	0904	0913	0921	0929	0938	1	3	4	6	7
24	1·0946	0955	0963	0972	0981	0989	0998	1007	1016	1025	1	3	4	6	7
25	1·1034	1043	1052	1061	1070	1079	1089	1098	1107	1117	2	3	5	6	8
26	1·1126	1136	1145	1155	1164	1174	1184	1194	1203	1213	2	3	5	6	8
27	1·1223	1233	1243	1253	1264	1274	1284	1294	1305	1315	2	3	5	7	9
28	1·1326	1336	1347	1357	1368	1379	1390	1401	1412	1423	2	4	5	7	9
29	1·1434	1445	1456	1467	1478	1490	1501	1512	1524	1535	2	4	6	8	9
30	1·1547	1559	1570	1582	1594	1606	1618	1630	1642	1654	2	4	6	8	10
31	1·1666	1679	1691	1703	1716	1728	1741	1753	1766	1779	2	4	6	8	10
32	1·1792	1805	1818	1831	1844	1857	1870	1883	1897	1910	2	4	7	9	11
33	1·1924	1937	1951	1964	1978	1992	2006	2020	2034	2048	2	5	7	9	12
34	1·2062	2076	2091	2105	2120	2134	2149	2163	2178	2193	2	5	7	10	12
35	1·2208	2223	2238	2253	2268	2283	2299	2314	2329	2345	3	5	8	10	13
36	1·2361	2376	2392	2408	2424	2440	2456	2472	2489	2505	3	5	8	11	13
37	1·2521	2538	2554	2571	2588	2605	2622	2639	2656	2673	3	6	8	11	14
38	1·2690	2708	2725	2742	2760	2778	2796	2813	2831	2849	3	6	9	12	15
39	1·2868	2886	2904	2923	2941	2960	2978	2997	3016	3035	3	6	9	12	16
40	1·3054	3073	3093	3112	3131	3151	3171	3190	3210	3230	3	7	10	13	16
41	1·3250	3270	3291	3311	3331	3352	3373	3393	3414	3435	3	7	10	14	17
42	1·3456	3478	3499	3520	3542	3563	3585	3607	3629	3651	4	7	11	14	18
43	1·3673	3696	3718	3741	3763	3786	3809	3832	3855	3878	4	8	11	15	19
44	1·3902	3925	3949	3972	3996	4020	4044	4069	4093	4118	4	8	12	16	20

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	1·4142	4167	4192	4217	4242	4267	4293	4318	4344	4370	4	8	13	17	21
46	1·4396	4422	4448	4474	4501	4527	4554	4581	4608	4635	4	9	13	18	22
47	1·4663	4690	4718	4746	4774	4802	4830	4859	4887	4916	5	9	14	19	23
48	1·4945	4974	5003	5032	5062	5092	5121	5151	5182	5212	5	10	15	20	25
49	1·5243	5273	5304	5335	5366	5398	5429	5461	5493	5525	5	10	16	21	26
50	1·5557	5590	5622	5655	5688	5721	5755	5788	5822	5856	6	11	17	22	28
51	1·5890	5925	5959	5994	6029	6064	6099	6135	6171	6207	6	12	18	23	29
52	1·6243	6279	6316	6353	6390	6427	6464	6502	6540	6578	6	12	19	25	31
53	1·6616	6655	6694	6733	6772	6812	6852	6892	6932	6972	7	13	20	26	33
54	1·7013	7054	7095	7137	7179	7221	7263	7305	7348	7391	7	14	21	28	35
55	1·7434	7478	7522	7566	7610	7655	7700	7745	7791	7837	7	15	22	30	37
56	1·7883	7929	7976	8023	8070	8118	8166	8214	8263	8312	8	16	24	32	40
57	1·8361	8410	8460	8510	8561	8612	8663	8714	8766	8818	8	17	25	34	42
58	1·8871	8924	8977	9031	9084	9139	9194	9249	9304	9360	9	18	27	36	45
59	1·9416	9473	9530	9587	9645	9703	9762	9821	9880	9940	10	19	29	39	49
60	2·0000	0061	0122	0183	0245	0308	0371	0434	0498	0562	10	21	31	42	52
61	2·0627	0692	0757	0824	0890	0957	1025	1093	1162	1231	11	22	34	45	56
62	2·1301	1371	1441	1513	1584	1657	1730	1803	1877	1952	12	24	36	48	61
63	2·2027	2103	2179	2256	2333	2412	2490	2570	2650	2730	13	26	39	52	65
64	2·2812	2894	2976	3060	3144	3228	3314	3400	3486	3574	14	28	43	57	71
65	2·3662	3751	3841	3931	4022	4114	4207	4300	4395	4490	15	31	46	62	77
66	2·4586	4683	4780	4879	4978	5078	5180	5282	5384	5488	17	34	50	67	84

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67	2·5593	5699	5805	5913	6022	6131	6242	6354	6466	6580	18	37	55	73	92
68	2·6695	6811	6927	7046	7165	7285	7407	7529	7653	7778	20	40	60	81	101
69	2·7904	8032	8161	8291	8422	8555	8688	8824	8960	9099	22	44	67	89	111
70	2·9238	9379	9521	9665	9811	9957	0106	0256	0407	0561	25	49	74	98	123
71	3·0716	0872	1030	1190	1352	1515	1681	1848	2017	2188	27	55	82	110	137
72	3·2361	2535	2712	2891	3072	3255	3440	3628	3817	4009	31	61	92	123	153
73	3·4203	4399	4598	4799	5003	5209	5418	5629	5843	6060	35	69	104	138	173
74	3·6280	6502	6727	6955	7186	7420	7657	7897	8140	8387	39	79	118	157	196
75	3·8637	8890	9147	9408	9672	9939	0211	0486	0765	1048	45	90	135	180	225
76	4·1336	1627	1923	2223	2527	2837	3150	3469	3792	4121	52	104	156	207	260
77	4·4454	4793	5137	5486	5841	6202	6569	6942	7321	7706	61	121	182	242	303
78	4·8097	8496	8901	9313	9732	0159	0593	1034	1484	1942	72	143	215	287	359
79	5·2408	2883	3367	3860	4362	4874	5396	5928	6470	7023	86	172	258	344	431
80	5·759	5·816	5·875	5·935	5·996	6·059	6·123	6·188	6·255	6·323					
81	6·392	5·464	6·537	6·611	6·687	6·765	6·845	6·927	7·011	7·097					
82	7·185	7·276	7·368	7·463	7·561	7·661	7·764	7·870	7·979	8·091					
83	8·206	8·324	8·446	8·571	8·700	8·834	8·971	9·113	9·259	9·411					
84	9·57	9·73	9·90	10·07	10·25	10·43	10·63	10·83	11·03	11·25					
85	11·47	11·71	11·95	12·20	12·47	12·75	13·03	13·34	13·65	13·99					
86	14·34	14·70	15·09	15·50	15·93	16·38	16·86	17·37	17·91	18·49					
87	19·11	19·77	20·47	21·23	22·04	22·93	23·88	24·92	26·05	27·29					
88	28·65	30·16	31·84	33·71	35·81	38·20	40·93	44·08	47·75	52·09					
89	57·30	63·66	71·62	81·85	95·49	114·6	143·2	191·0	286·5	573·0					
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

Differences untrustworthy here

The black type indicates that the integer changes.

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
0°	∞	573·0	286·5	191·0	143·2	114·6	95·49	81·85	71·62	63·66					
1	57·30	52·09	47·75	44·08	40·93	38·20	35·81	33·71	31·84	30·16					
2	28·65	27·29	26·05	24·92	23·88	22·93	22·04	21·23	20·47	19·77		*Differences*			
3	19·11	18·49	17·91	17·37	16·86	16·38	15·93	15·50	15·09	14·70		*untrustworthy*			
4	14·34	13·99	13·65	13·34	13·03	12·75	12·47	12·20	11·95	11·71		*here*			
5	11·47	11·25	11·03	10·83	10·63	10·43	10·25	10·07	9·90	9·73					
6	9·567	9·411	9·259	9·113	8·971	8·834	8·700	8·571	8·446	8·324					
7	8·206	8·091	7·979	7·870	7·764	7·661	7·561	7·463	7·368	7·276					
8	7·185	7·097	7·011	6·927	6·845	6·765	6·687	6·611	6·537	6·464					
9	6·392	6·323	6·255	6·188	6·123	6·059	5·996	5·935	5·875	5·816					
10	5·7588	7023	6470	5928	5396	4874	4362	3860	3367	2883	86	172	258	344	431
11	5·2408	1942	1484	1034	0593	0159	9732	9313	8901	8496	72	143	215	287	359
12	4·8097	7706	7321	6942	6569	6202	5841	5486	5137	4793	61	121	182	242	303
13	4·4454	4121	3792	3469	3150	2837	2527	2223	1923	1627	52	104	156	207	260
14	4·1336	1048	0765	0486	0211	9939	9672	9408	9147	8890	45	90	135	180	225
15	3·8637	8387	8140	7897	7657	7420	7186	6955	6727	6502	39	79	118	157	196
16	3·6280	6060	5843	5629	5418	5209	5003	4799	4598	4399	35	69	104	138	173
17	3·4203	4009	3817	3628	3440	3255	3072	2891	2712	2535	31	61	92	123	153
18	3·2361	2188	2017	1848	1681	1515	1352	1190	1030	0872	27	55	82	110	137
19	3·0716	0561	0407	0256	0106	9957	9811	9665	9521	9379	25	49	74	98	123
20	2·9238	9099	8960	8824	8688	8555	8422	8291	8161	8032	22	44	67	89	111
21	2·7904	7778	7653	7529	7407	7285	7165	7046	6927	6811	20	40	60	81	101
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
22	2·6695	6580	6466	6354	6242	6131	6022	5913	5805	5699	18	37	55	73	92
23	2·5593	5488	5384	5282	5180	5078	4978	4879	4780	4683	17	34	50	67	84
24	2·4586	4490	4395	4300	4207	4114	4022	3931	3841	3751	15	31	46	62	77
25	2·3662	3574	3486	3400	3314	3228	3144	3060	2976	2894	14	28	43	57	71
26	2·2812	2730	2650	2570	2490	2412	2333	2256	2179	2103	13	26	39	52	65
27	2·2027	1952	1877	1803	1730	1657	1584	1513	1441	1371	12	24	36	48	61
28	2·1301	1231	1162	1093	1025	0957	0890	0824	0757	0692	11	22	34	45	56
29	2·0627	0562	0498	0434	0371	0308	0245	0183	0122	0061	10	21	31	42	52
30	2·0000	9940	9880	9821	9762	9703	9645	9587	9530	9473	10	19	29	39	49
31	1·9416	9360	9304	9249	9194	9139	9084	9031	8977	8924	9	18	27	36	45
32	1·8871	8818	8766	8714	8663	8612	8561	8510	8460	8410	8	17	25	34	42
33	1·8361	8312	8263	8214	8166	8118	8070	8023	7976	7929	8	16	24	32	40
34	1·7883	7837	7791	7745	7700	7655	7610	7566	7522	7478	7	15	22	30	37
35	1·7434	7391	7348	7305	7263	7221	7179	7137	7095	7054	7	14	21	28	35
36	1·7013	6972	6932	6892	6852	6812	6772	6733	6694	6655	7	13	20	26	33
37	1·6616	6578	6540	6502	6464	6427	6390	6353	6316	6279	6	12	19	25	31
38	1·6243	6207	6171	6135	6099	6064	6029	5994	5959	5925	6	12	18	23	29
39	1·5890	5856	5822	5788	5755	5721	5688	5655	5622	5590	6	11	17	22	28
40	1·5557	5525	5493	5461	5429	5398	5366	5335	5304	5273	5	10	16	21	26
41	1·5243	5212	5182	5151	5121	5092	5062	5032	5003	4975	5	10	15	20	25
42	1·4945	4916	4887	4859	4830	4802	4774	4746	4718	4690	4	9	14	19	23
43	1·4663	4635	4608	4581	4554	4527	4501	4474	4448	4422	4	9	13	18	22
44	1·4396	4370	4344	4318	4293	4267	4242	4217	4192	4167	4	8	13	17	21
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

The black type indicates that the integer changes.

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
45°	1·4142	4118	4093	4069	4044	4020	3996	3972	3949	3925	4	8	12	16	20
46	1·3902	3878	3855	3832	3809	3786	3763	3741	3718	3696	4	8	11	15	19
47	1·3673	3651	3629	3607	3585	3563	3542	3520	3499	3478	4	7	11	14	18
48	1·3456	3435	3414	3393	3373	3352	3331	3311	3291	3270	3	7	10	14	17
49	1·3250	3230	3210	3190	3171	3151	3131	3112	3093	3073	3	7	10	13	16
50	1·3054	3035	3016	2997	2978	2960	2941	2923	2904	2886	3	6	9	12	16
51	1·2868	2849	2831	2813	2796	2778	2760	2742	2725	2708	3	6	9	12	15
52	1·2690	2673	2656	2639	2622	2605	2588	2571	2554	2538	3	6	8	11	14
53	1·2521	2505	2489	2472	2456	2440	2424	2408	2392	2376	3	5	8	11	13
54	1·2361	2345	2329	2314	2299	2283	2268	2253	2238	2223	3	5	8	10	13
55	1·2208	2193	2178	2163	2149	2134	2120	2105	2091	2076	2	5	7	10	12
56	1·2062	2048	2034	2020	2006	1992	1978	1964	1951	1937	2	5	7	9	12
57	1·1924	1910	1897	1883	1870	1857	1844	1831	1818	1805	2	4	7	9	11
58	1·1792	1779	1766	1753	1741	1728	1716	1703	1691	1679	2	4	6	8	10
59	1·1666	1654	1642	1630	1618	1606	1594	1582	1570	1559	2	4	6	8	10
60	1·1547	1535	1524	1512	1501	1490	1478	1467	1456	1445	2	4	6	8	9
61	1·1434	1423	1412	1401	1390	1379	1368	1357	1347	1336	2	4	5	7	9
62	1·1326	1315	1305	1294	1284	1274	1264	1253	1243	1233	2	3	5	7	8
63	1·1223	1213	1203	1194	1184	1174	1164	1155	1145	1136	2	3	5	6	8
64	1·1126	1117	1107	1098	1089	1079	1070	1061	1052	1043	2	3	5	6	8
65	1·1034	1025	1016	1007	0998	0989	0981	0972	0963	0955	1	3	4	6	7
66	1·0946	0938	0929	0921	0913	0904	0896	0888	0880	0872	1	3	4	6	7
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'
67	1·0864	0856	0848	0840	0832	0824	0816	0808	0801	0793	1	3	4	5	7
68	1·0785	0778	0770	0763	0755	0748	0740	0733	0726	0719	1	2	4	5	6
69	1·0711	0704	0697	0690	0683	0676	0669	0662	0655	0649	1	2	3	5	6
70	1·0642	0635	0628	0622	0615	0608	0602	0595	0589	0583	1	2	3	4	5
71	1·0576	0570	0564	0557	0551	0545	0539	0533	0527	0521	1	2	3	4	5
72	1·0515	0509	0503	0497	0491	0485	0480	0474	0468	0463	1	2	3	4	4
73	1·0457	0451	0446	0440	0435	0429	0424	0419	0413	0408	1	2	3	4	4
74	1·0403	0398	0393	0388	0382	0377	0372	0367	0363	0358	1	2	3	3	4
75	1·0353	0348	0343	0338	0334	0329	0324	0320	0315	0311	1	2	2	3	4
76	1·0306	0302	0297	0293	0288	0284	0280	0276	0271	0267	1	1	2	3	3
77	1·0263	0259	0255	0251	0247	0243	0239	0235	0231	0227	1	1	2	3	3
78	1·0223	0220	0216	0212	0209	0205	0201	0198	0194	0191	1	1	2	2	3
79	1·0187	0184	0180	0177	0174	0170	0167	0164	0161	0157	1	1	2	2	3
80	1·0154	0151	0148	0145	0142	0139	0136	0133	0130	0127	1	1	1	2	2
81	1·0125	0122	0119	0116	0114	0111	0108	0106	0103	0101	0	1	1	2	2
82	1·0098	0096	0093	0091	0089	0086	0084	0082	0079	0077	0	1	1	1	2
83	1·0075	0073	0071	0069	0067	0065	0063	0061	0059	0057	0	1	1	1	1
84	1·0055	0053	0051	0050	0048	0046	0045	0043	0041	0040	0	1	1	1	1
85	1·0038	0037	0035	0034	0032	0031	0030	0028	0027	0026	0	0	1	1	2
86	1·0024	0023	0022	0021	0020	0019	0018	0017	0016	0015	0	0	0	1	1
87	1·0014	0013	0012	0011	0010	0010	0009	0008	0007	0007	0	0	0	0	1
88	1·0006	0006	0005	0004	0004	0003	0003	0003	0002	0002	0	0	0	0	1
89	1·0002	0001	0001	0001	0001	0000	0000	0000	0000	0000	0	0	0	0	1
	0'	6'	12'	18'	24'	30'	36'	42'	48'	54'	1'	2'	3'	4'	5'

RECIPROCALS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
1·0	1·0000	·9901	·9804	·9709	·9615	·9524	·9434	·9346	·9259	·9174	9	18	27	36	45	55	64	73	82
1·1	·9091	·9009	·8929	·8850	·8772	·8696	·8621	·8547	·8475	·8403	8	15	23	30	38	45	53	61	68
1·2	·8333	·8264	·8197	·8130	·8065	·8000	·7937	·7874	·7813	·7752	6	13	19	26	32	38	45	51	58
1·3	·7692	·7634	·7576	·7519	·7463	·7407	·7353	·7299	·7246	·7194	5	11	16	22	27	33	38	44	49
1·4	·7143	·7092	·7042	·6993	·6944	·6897	·6849	·6803	·6757	·6711	5	10	14	19	24	29	33	38	43
1·5	·6667	·6623	·6579	·6536	·6494	·6452	·6410	·6369	·6329	·6289	4	8	13	17	21	25	29	33	38
1·6	·6250	·6211	·6173	·6135	·6098	·6061	·6024	·5988	·5952	·5917	4	7	11	15	18	22	26	29	33
1·7	·5882	·5848	·5814	·5780	·5747	·5714	·5682	·5650	·5618	·5587	3	7	10	13	16	20	23	26	30
1·8	·5556	·5525	·5495	·5464	·5435	·5405	·5376	·5348	·5319	·5291	3	6	9	12	15	18	20	23	26
1·9	·5263	·5236	·5208	·5181	·5155	·5128	·5102	·5076	·5051	·5025	3	5	8	11	13	16	18	21	24
2·0	·5000	·4975	·4950	·4926	·4902	·4878	·4854	·4831	·4808	·4785	2	5	7	10	12	14	17	19	21
2·1	·4762	·4739	·4717	·4695	·4673	·4651	·4630	·4608	·4587	·4566	2	4	7	9	11	13	15	17	20
2·2	·4545	·4525	·4505	·4484	·4464	·4444	·4425	·4405	·4386	·4367	2	4	6	8	10	12	14	16	18
2·3	·4348	·4329	·4310	·4292	·4274	·4255	·4237	·4219	·4202	·4184	2	4	5	7	9	11	13	14	16
2·4	·4167	·4149	·4132	·4115	·4098	·4082	·4065	·4049	·4032	·4016	2	3	5	7	8	10	12	14	15
2·5	·4000	·3984	·3968	·3953	·3937	·3922	·3906	·3891	·3876	·3861	2	3	5	6	8	9	11	12	14
2·6	·3846	·3831	·3817	·3802	·3788	·3774	·3759	·3745	·3731	·3717	1	3	4	6	7	9	10	11	13
2·7	·3704	·3690	·3676	·3663	·3650	·3636	·3623	·3610	·3597	·3584	1	3	4	5	7	8	9	11	12
2·8	·3571	·3559	·3546	·3534	·3521	·3509	·3497	·3484	·3472	·3460	1	2	4	5	6	7	8	10	11
2·9	·3448	·3436	·3425	·3413	·3401	·3390	·3378	·3367	·3356	·3344	1	2	3	5	6	7	8	9	10
3·0	·3333	·3322	·3311	·3300	·3289	·3279	·3268	·3257	·3247	·3236	1	2	3	4	5	6	7	9	10
3·1	·3226	·3215	·3205	·3195	·3185	·3175	·3165	·3155	·3145	·3135	1	2	3	4	5	6	7	8	9

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
3·2	·3125	·3115	·3106	·3096	·3086	·3077	·3067	·3058	·3049	·3040	1	2	3	4	5	6	7	8	9
3·3	·3030	·3021	·3012	·3003	·2994	·2985	·2976	·2967	·2959	·2950	1	2	3	4	5	5	6	7	8
3·4	·2941	·2933	·2924	·2915	·2907	·2899	·2890	·2882	·2874	·2865	1	2	2	3	4	5	6	7	8
3·5	·2857	·2849	·2841	·2833	·2825	·2817	·2809	·2801	·2793	·2786	1	2	2	3	4	5	6	7	7
3·6	·2778	·2770	·2762	·2755	·2747	·2740	·2732	·2725	·2717	·2710	1	2	2	3	4	5	5	6	7
3·7	·2703	·2695	·2688	·2681	·2674	·2667	·2660	·2653	·2646	·2639	1	1	2	3	3	4	5	6	6
3·8	·2632	·2625	·2618	·2611	·2604	·2597	·2591	·2584	·2577	·2571	1	1	2	3	3	4	5	5	6
3·9	·2564	·2558	·2551	·2545	·2538	·2532	·2525	·2519	·2513	·2506	1	1	2	2	3	4	5	5	6
4·0	·2500	·2494	·2488	·2481	·2475	·2469	·2463	·2457	·2451	·2445	1	1	2	2	3	4	4	5	5
4·1	·2439	·2433	·2427	·2421	·2415	·2410	·2404	·2398	·2392	·2387	1	1	2	2	3	4	4	5	5
4·2	·2381	·2375	·2370	·2364	·2358	·2353	·2347	·2342	·2336	·2331	1	1	2	2	3	3	4	5	5
4·3	·2326	·2320	·2315	·2309	·2304	·2299	·2294	·2288	·2283	·2278	1	1	2	2	3	3	4	4	5
4·4	·2273	·2268	·2262	·2257	·2252	·2247	·2242	·2237	·2232	·2227	0	1	1	2	2	3	3	4	4
4·5	·2222	·2217	·2212	·2208	·2203	·2198	·2193	·2188	·2183	·2179	0	1	1	2	2	3	3	4	4
4·6	·2174	·2169	·2165	·2160	·2155	·2151	·2146	·2141	·2137	·2132	0	1	1	2	2	3	3	4	4
4·7	·2128	·2123	·2119	·2114	·2110	·2105	·2101	·2096	·2092	·2088	0	1	1	2	2	3	3	4	4
4·8	·2083	·2079	·2075	·2070	·2066	·2062	·2058	·2053	·2049	·2045	0	1	1	2	2	2	3	3	4
4·9	·2041	·2037	·2033	·2028	·2024	·2020	·2016	·2012	·2008	·2004	0	1	1	1	2	2	3	3	4
5·0	·2000	·1996	·1992	·1988	·1984	·1980	·1976	·1972	·1969	·1965	0	1	1	1	2	2	3	3	4
5·1	·1961	·1957	·1953	·1949	·1946	·1942	·1938	·1934	·1931	·1927	0	1	1	1	2	2	3	3	3
5·2	·1923	·1919	·1916	·1912	·1908	·1905	·1901	·1898	·1894	·1890	0	1	1	1	2	2	3	3	3
5·3	·1887	·1883	·1880	·1876	·1873	·1869	·1866	·1862	·1859	·1855	0	1	1	1	2	2	3	3	3
5·4	·1852	·1848	·1845	·1842	·1838	·1835	·1832	·1828	·1825	·1821	0	1	1	1	2	2	2	3	3

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	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
5·5	·1818	·1815	·1812	·1808	·1805	·1802	·1799	·1795	·1792	·1789	0	1	1	1	2	2	2	3	3
5·6	·1786	·1783	·1779	·1776	·1773	·1770	·1767	·1764	·1761	·1757	0	1	1	1	2	2	2	3	3
5·7	·1754	·1751	·1748	·1745	·1742	·1739	·1736	·1733	·1730	·1727	0	1	1	1	2	2	2	2	3
5·8	·1724	·1721	·1718	·1715	·1712	·1709	·1706	·1704	·1701	·1698	0	1	1	1	1	2	2	2	3
5·9	·1695	·1692	·1689	·1686	·1684	·1681	·1678	·1675	·1672	·1669	0	1	1	1	1	2	2	2	3
6·0	·1667	·1664	·1661	·1658	·1656	·1653	·1650	·1647	·1645	·1642	0	1	1	1	1	2	2	2	2
6·1	·1639	·1637	·1634	·1631	·1629	·1626	·1623	·1621	·1618	·1616	0	1	1	1	1	2	2	2	2
6·2	·1613	·1610	·1608	·1605	·1603	·1600	·1597	·1595	·1592	·1590	0	0	1	1	1	2	2	2	2
6·3	·1587	·1585	·1582	·1580	·1577	·1575	·1572	·1570	·1567	·1565	0	0	1	1	1	1	2	2	2
6·4	·1563	·1560	·1558	·1555	·1553	·1550	·1548	·1546	·1543	·1541	0	0	1	1	1	1	2	2	2
6·5	·1538	·1536	·1534	·1531	·1529	·1527	·1524	·1522	·1520	·1517	0	0	1	1	1	1	2	2	2
6·6	·1515	·1513	·1511	·1508	·1506	·1504	·1502	·1499	·1497	·1495	0	0	1	1	1	1	1	2	2
6·7	·1493	·1490	·1488	·1486	·1484	·1481	·1479	·1477	·1475	·1473	0	0	1	1	1	1	1	2	2
6·8	·1471	·1468	·1466	·1464	·1462	·1460	·1458	·1456	·1453	·1451	0	0	1	1	1	1	1	2	2
6·9	·1449	·1447	·1445	·1443	·1441	·1439	·1437	·1435	·1433	·1431	0	0	1	1	1	1	1	1	2
7·0	·1429	·1427	·1425	·1422	·1420	·1418	·1416	·1414	·1412	·1410	0	0	1	1	1	1	1	1	2
7·1	·1408	·1406	·1404	·1403	·1401	·1399	·1397	·1395	·1393	·1391	0	0	1	1	1	1	1	1	2
7·2	·1389	·1387	·1385	·1383	·1381	·1379	·1377	·1376	·1374	·1372	0	0	1	1	1	1	1	1	2
7·3	·1370	·1368	·1366	·1364	·1362	·1361	·1359	·1357	·1355	·1353	0	0	1	1	1	1	1	1	2
7·4	·1351	·1350	·1348	·1346	·1344	·1342	·1340	·1339	·1337	·1335	0	0	1	1	1	1	1	1	1
7·5	·1333	·1332	·1330	·1328	·1326	·1325	·1323	·1321	·1319	·1318	0	0	1	1	1	1	1	1	2
7·6	·1316	·1314	·1312	·1311	·1309	·1307	·1305	·1304	·1302	·1300	0	0	1	1	1	1	1	1	1

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	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
7·7	·1299	·1297	·1295	·1294	·1292	·1290	·1289	·1287	·1285	·1284	0	0	0	1	1	1	1	1	1
7·8	·1282	·1280	·1279	·1277	·1276	·1274	·1272	·1271	·1269	·1267	0	0	0	1	1	1	1	1	1
7·9	·1266	·1264	·1263	·1261	·1259	·1258	·1256	·1255	·1253	·1252	0	0	0	1	1	1	1	1	1
8·0	·1250	·1248	·1247	·1245	·1244	·1242	·1241	·1239	·1238	·1236	0	0	0	1	1	1	1	1	1
8·1	·1235	·1233	·1232	·1230	·1229	·1227	·1225	·1224	·1222	·1221	0	0	0	0	1	1	1	1	1
8·2	·1220	·1218	·1217	·1215	·1214	·1212	·1211	·1209	·1208	·1206	0	0	0	1	1	1	1	1	1
8·3	·1205	·1203	·1202	·1200	·1199	·1198	·1196	·1195	·1193	·1192	0	0	0	0	1	1	1	1	1
8·4	·1190	·1189	·1188	·1186	·1185	·1183	·1182	·1181	·1179	·1178	0	0	0	0	1	1	1	1	1
8·5	·1176	·1175	·1174	·1172	·1171	·1170	·1168	·1167	·1166	·1164	0	0	0	0	1	1	1	1	1
8·6	·1163	·1161	·1160	·1159	·1157	·1156	·1155	·1153	·1152	·1151	0	0	0	0	1	1	1	1	1
8·7	·1149	·1148	·1147	·1145	·1144	·1143	·1142	·1140	·1139	·1138	0	0	0	0	1	1	1	1	1
8·8	·1136	·1135	·1134	·1133	·1131	·1130	·1129	·1127	·1126	·1125	0	0	0	0	1	1	1	1	1
8·9	·1124	·1122	·1121	·1120	·1119	·1117	·1116	·1115	·1114	·1112	0	0	0	0	1	1	1	1	1
9·0	·1111	·1110	·1109	·1107	·1106	·1105	·1104	·1103	·1101	·1100	0	0	0	0	1	1	1	1	1
9·1	·1099	·1098	·1096	·1095	·1094	·1093	·1092	·1091	·1089	·1088	0	0	0	0	0	1	1	1	1
9·2	·1087	·1086	·1085	·1083	·1082	·1081	·1080	·1079	·1078	·1076	0	0	0	0	0	1	1	1	1
9·3	·1075	·1074	·1073	·1072	·1071	·1070	·1068	·1067	·1066	·1065	0	0	0	0	1	1	1	1	1
9·4	·1064	·1063	·1062	·1060	·1059	·1058	·1057	·1056	·1055	·1054	0	0	0	0	0	1	1	1	1
9·5	·1053	·1052	·1050	·1049	·1048	·1047	·1046	·1045	·1044	·1043	0	0	0	0	0	1	1	1	1
9·6	·1042	·1041	·1040	·1038	·1037	·1036	·1035	·1034	·1033	·1032	0	0	0	0	0	1	1	1	1
9·7	·1031	·1030	·1029	·1028	·1027	·1026	·1025	·1024	·1022	·1021	0	0	0	0	1	1	1	1	1
9·8	·1020	·1019	·1018	·1017	·1016	·1015	·1014	·1013	·1012	·1011	0	0	0	0	0	1	1	1	1
9·9	·1010	·1009	·1008	·1007	·1006	·1005	·1004	·1003	·1002	·1001	0	0	0	0	0	0	1	1	1

NAPIERIAN LOGARITHMS $\log_e N$

N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
1·0	0·0000	0100	0198	0296	0392	0488	0583	0677	0770	0862	10	19	29	38	48	57	67	76	86
1·1	0·0953	1044	1133	1222	1310	1398	1484	1570	1655	1740	9	17	26	35	44	52	61	70	78
1·2	0·1823	1906	1989	2070	2151	2231	2311	2390	2469	2546	8	16	24	32	40	48	56	64	72
1·3	0·2624	2700	2776	2852	2927	3001	3075	3148	3221	3293	7	15	22	30	37	44	52	59	67
1·4	0·3365	3436	3507	3577	3646	3716	3784	3853	3920	3988	7	14	21	28	35	41	48	55	62
1·5	0·4055	4121	4187	4253	4318	4383	4447	4511	4574	4637	6	13	19	26	32	39	45	52	58
1·6	0·4700	4762	4824	4886	4947	5008	5068	5128	5188	5247	6	12	18	24	30	36	42	48	55
1·7	0·5306	5365	5423	5481	5539	5596	5653	5710	5766	5822	6	11	17	23	29	34	40	46	51
1·8	0·5878	5933	5988	6043	6098	6152	6206	6259	6313	6366	5	11	16	22	27	32	38	43	49
1·9	0·6419	6471	6523	6575	6627	6678	6729	6780	6831	6881	5	10	15	20	26	31	36	41	46
2·0	0·6931	6981	7031	7080	7129	7178	7227	7275	7324	7372	5	10	15	20	24	29	34	39	44
2·1	0·7419	7467	7514	7561	7608	7655	7701	7747	7793	7839	5	9	14	18	23	28	33	37	42
2·2	0·7885	7930	7975	8020	8065	8109	8154	8198	8242	8286	4	9	13	18	22	27	31	36	40
2·3	0·8329	8372	8416	8459	8502	8544	8587	8629	8671	8713	4	9	13	17	21	26	30	34	38
2·4	0·8755	8796	8838	8879	8920	8961	9002	9042	9083	9123	4	8	12	16	20	24	29	33	37
2·5	0·9163	9203	9243	9282	9322	9361	9400	9439	9478	9517	4	8	12	16	20	24	27	31	35
2·6	0·9555	9594	9632	9670	9708	9746	9783	9821	9858	9895	4	8	11	15	19	23	26	30	34
2·7	0·9933	9969	**0006**	0043	0080	0116	0152	0188	0225	0260	4	7	11	15	18	22	25	29	33
2·8	1·0296	0332	0367	0403	0438	0473	0508	0543	0578	0613	4	7	11	14	18	21	25	28	32
2·9	1·0647	0682	0716	0750	0784	0818	0852	0886	0919	0953	3	7	10	14	17	20	24	27	31
3·0	1·0986	1019	1053	1086	1119	1151	1184	1217	1249	1282	3	7	10	13	16	20	23	26	30
3·1	1·1314	1346	1378	1410	1442	1474	1506	1537	1569	1600	3	6	10	13	16	19	22	25	29
3·2	1·1632	1663	1694	1725	1756	1787	1817	1848	1878	1909	3	6	9	12	15	18	22	25	28
3·3	1·1939	1969	2000	2030	2060	2090	2119	2149	2179	2208	3	6	9	12	15	18	21	24	27
3·4	1·2238	2267	2296	2326	2355	2384	2413	2442	2470	2499	3	6	9	12	15	17	20	23	26

The black type indicates that the integer changes.

N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
3·5	1·2528	2556	2585	2613	2641	2669	2698	2726	2754	2782	3	6	8	11	14	17	20	22	25
3·6	1·2809	2837	2865	2892	2920	2947	2975	3002	3029	3056	3	5	8	11	14	16	19	22	25
3·7	1·3083	3110	3137	3164	3191	3218	3244	3271	3297	3324	3	5	8	11	13	16	19	21	24
3·8	1·3350	3376	3403	3429	3455	3481	3507	3533	3558	3584	3	5	8	10	13	16	18	21	23
3·9	1·3610	3635	3661	3686	3712	3737	3762	3788	3813	3838	3	5	8	10	13	15	18	20	23
4·0	1·3863	3888	3913	3938	3962	3987	4012	4036	4061	4085	2	5	7	10	12	15	17	20	22
4·1	1·4110	4134	4159	4183	4207	4231	4255	4279	4303	4327	2	5	7	10	12	15	17	19	22
4·2	1·4351	4375	4398	4422	4446	4469	4493	4516	4540	4563	2	5	7	9	12	14	16	19	21
4·3	1·4586	4609	4633	4656	4679	4702	4725	4748	4770	4793	2	5	7	9	12	14	16	18	21
4·4	1·4816	4839	4861	4884	4907	4929	4951	4974	4996	5019	2	5	7	9	11	14	16	18	20
4·5	1·5041	5063	5085	5107	5129	5151	5173	5195	5217	5239	2	4	7	9	11	13	15	18	20
4·6	1·5261	5282	5304	5326	5347	5369	5390	5412	5433	5454	2	4	7	9	11	13	15	17	19
4·7	1·5476	5497	5518	5539	5560	5581	5602	5623	5644	5665	2	4	6	8	11	13	15	17	19
4·8	1·5686	5707	5728	5748	5769	5790	5810	5831	5851	5872	2	4	6	8	10	12	14	16	19
4·9	1·5892	5913	5933	5953	5974	5994	6014	6034	6054	6074	2	4	6	8	10	12	14	16	18
5·0	1·6094	6114	6134	6154	6174	6194	6214	6233	6253	6273	2	4	6	8	10	12	14	16	18
5·1	1·6292	6312	6332	6351	6371	6390	6409	6429	6448	6467	2	4	6	8	10	12	14	15	18
5·2	1·6487	6506	6525	6544	6563	6582	6601	6620	6639	6658	2	4	6	8	10	11	13	15	17
5·3	1·6677	6696	6715	6734	6752	6771	6790	6808	6827	6845	2	4	6	8	9	11	13	15	17
5·4	1·6864	6882	6901	6919	6938	6956	6974	6993	7011	7029	2	4	5	7	9	11	13	15	16

N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

For further values, e.g. $\log_e 4560$, write $4560 = 4·560 \times 10^3$ and use the table below.

$\log_e 10^x$

x	1	2	3	4	5	6
$\log_e 10^x$	2·3026	4·6052	6·9078	9·2103	11·5129	13·8155

N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
5·5	1·7047	7066	7084	7102	7120	7138	7156	7174	7192	7210	2	4	5	7	9	11	13	14	16
5·6	1·7228	7246	7263	7281	7299	7317	7334	7352	7370	7387	2	4	5	7	9	11	13	14	16
5·7	1·7405	7422	7440	7457	7475	7492	7509	7527	7544	7561	2	3	5	7	9	10	12	14	16
5·8	1·7579	7596	7613	7630	7647	7664	7681	7699	7716	7733	2	3	5	7	9	10	12	14	15
5·9	1·7750	7766	7783	7800	7817	7834	7851	7867	7884	7901	2	3	5	7	8	10	12	13	15
6·0	1·7918	7934	7951	7967	7984	8001	8017	8034	8050	8066	2	3	5	7	8	10	12	13	15
6·1	1·8083	8099	8116	8132	8148	8165	8181	8197	8213	8229	2	3	5	6	8	10	11	13	15
6·2	1·8245	8262	8278	8294	8310	8326	8342	8358	8374	8390	2	3	5	6	8	10	11	13	14
6·3	1·8405	8421	8437	8453	8469	8485	8500	8516	8532	8547	2	3	5	6	8	9	11	13	14
6·4	1·8563	8579	8594	8610	8625	8641	8656	8672	8687	8703	2	3	5	6	8	9	11	12	14
6·5	1·8718	8733	8749	8764	8779	8795	8810	8825	8840	8856	2	3	5	6	8	9	11	12	14
6·6	1·8871	8886	8901	8916	8931	8946	8961	8976	8991	9006	2	3	4	6	7	9	10	12	13
6·7	1·9021	9036	9051	9066	9081	9095	9110	9125	9140	9155	2	3	4	6	7	9	10	12	13
6·8	1·9169	9184	9199	9213	9228	9242	9257	9272	9286	9301	1	3	4	6	7	9	10	11	13
6·9	1·9315	9330	9344	9359	9373	9387	9402	9416	9430	9445	1	3	4	6	7	8	10	11	12
7·0	1·9459	9473	9488	9502	9516	9530	9544	9559	9573	9587	1	3	4	6	7	8	10	11	12
7·1	1·9601	9615	9629	9643	9657	9671	9685	9699	9713	9727	1	3	4	6	7	8	10	11	12
7·2	1·9741	9755	9769	9782	9796	9810	9824	9838	9851	9865	1	3	4	6	7	8	10	11	12
7·3	1·9879	9892	9906	9920	9933	9947	9961	9974	9988	**0001**	1	3	4	5	7	8	10	11	12
7·4	2·0015	0028	0042	0055	0069	0082	0096	0109	0122	0136	1	3	4	5	7	8	9	11	12
7·5	2·0149	0162	0176	0189	0202	0215	0229	0242	0255	0268	1	3	4	5	6	8	9	10	12
7·6	2·0281	0295	0308	0321	0334	0347	0360	0373	0386	0399	1	3	4	5	6	8	9	10	12
7·7	2·0412	0425	0438	0451	0464	0477	0490	0503	0516	0528	1	3	4	5	6	8	9	10	11
7·8	2·0541	0554	0567	0580	0592	0605	0618	0631	0643	0656	1	3	4	5	6	7	9	10	11
7·9	2·0669	0681	0694	0707	0719	0732	0744	0757	0769	0782	1	3	4	5	6	7	9	10	11

The black type indicates that the integer changes.

N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
8·0	2·0794	0807	0819	0832	0844	0857	0869	0882	0894	0906	1	2	4	5	6	7	9	10	11
8·1	2·0919	0931	0943	0956	0968	0980	0992	1005	1017	1029	1	2	4	5	6	7	9	10	11
8·2	2·1041	1054	1066	1078	1090	1102	1114	1126	1138	1150	1	2	4	5	6	7	8	10	11
8·3	2·1163	1175	1187	1199	1211	1223	1235	1247	1258	1270	1	2	4	5	6	7	8	10	11
8·4	2·1282	1294	1306	1318	1330	1342	1353	1365	1377	1389	1	2	4	5	6	7	8	10	11
8·5	2·1401	1412	1424	1436	1448	1459	1471	1483	1494	1506	1	2	4	5	6	7	8	9	11
8·6	2·1518	1529	1541	1552	1564	1576	1587	1599	1610	1622	1	2	3	5	6	7	8	9	10
8·7	2·1633	1645	1656	1668	1679	1691	1702	1713	1725	1736	1	2	3	5	6	7	8	9	10
8·8	2·1748	1759	1770	1782	1793	1804	1815	1827	1838	1849	1	2	3	4	5	7	8	9	10
8·9	2·1861	1872	1883	1894	1905	1917	1928	1939	1950	1961	1	2	3	4	6	7	8	9	10
9·0	2·1972	1983	1994	2006	2017	2028	2039	2050	2061	2072	1	2	3	4	5	7	8	9	10
9·1	2·2083	2094	2105	2116	2127	2138	2148	2159	2170	2181	1	2	3	4	5	7	8	9	10
9·2	2·2192	2203	2214	2225	2235	2246	2257	2268	2279	2289	1	2	3	4	5	6	8	9	10
9·3	2·2300	2311	2322	2332	2343	2354	2364	2375	2386	2396	1	2	3	4	5	6	8	9	10
9·4	2·2407	2418	2428	2439	2450	2460	2471	2481	2492	2502	1	2	3	4	5	6	7	8	10
9·5	2·2513	2523	2534	2544	2555	2565	2576	2586	2597	2607	1	2	3	4	5	6	7	8	9
9·6	2·2618	2628	2638	2649	2659	2670	2680	2690	2701	2711	1	2	3	4	5	6	7	8	9
9·7	2·2721	2732	2742	2752	2762	2773	2783	2793	2803	2814	1	2	3	4	5	6	7	8	9
9·8	2·2824	2834	2844	2854	2865	2875	2885	2895	2905	2915	1	2	3	4	5	6	7	8	9
9·9	2·2925	2935	2946	2956	2966	2976	2986	2996	3006	3016	1	2	3	4	5	6	7	8	9

$\text{LOG}_e\ 10^{-x}$

x	1	2	3	4	5	6
$\log_e 10^{-x}$	$\overline{3}\cdot6974$	$\overline{5}\cdot3948$	$\overline{7}\cdot0922$	$\overline{10}\cdot7897$	$\overline{12}\cdot4871$	$\overline{14}\cdot1845$

x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
0·0	1·0000	1·0101	1·0202	1·0305	1·0408	1·0513	1·0618	1·0725	1·0833	1·0942
0·1	1·1052	1·1163	1·1275	1·1388	1·1503	1·1618	1·1735	1·1853	1·1972	1·2092
0·2	1·2214	1·2337	1·2461	1·2586	1·2712	1·2840	1·2969	1·3100	1·3231	1·3364
0·3	1·3499	1·3634	1·3771	1·3910	1·4049	1·4191	1·4333	1·4477	1·4623	1·4770
0·4	1·4918	1·5068	1·5220	1·5373	1·5527	1·5683	1·5841	1·6000	1·6161	1·6323
0·5	1·6487	1·6653	1·6820	1·6989	1·7160	1·7333	1·7507	1·7683	1·7860	1·8040
0·6	1·8221	1·8404	1·8589	1·8776	1·8965	1·9155	1·9348	1·9542	1·9739	1·9937
0·7	2·0138	2·0340	2·0544	2·0751	2·0959	2·1170	2·1383	2·1598	2·1815	2·2034
0·8	2·2255	2·2479	2·2705	2·2933	2·3164	2·3396	2·3632	2·3869	2·4109	2·4351
0·9	2·4596	2·4843	2·5093	2·5345	2·5600	2·5857	2·6117	2·6379	2·6645	2·6912
1·0	2·7183	2·7456	2·7732	2·8011	2·8292	2·8576	2·8864	2·9154	2·9447	2·9743
1·1	3·0042	3·0344	3·0649	3·0975	3·1268	3·1582	3·1899	3·2220	3·2544	3·2871
1·2	3·3201	3·3535	3·3872	3·4212	3·4556	3·4903	3·5254	3·5608	3·5966	3·6328
1·3	3·6693	3·7062	3·7434	3·7810	3·8190	3·8574	3·8962	3·9354	3·9749	4·0149
1·4	4·0552	4·0960	4·1371	4·1787	4·2207	4·2631	4·3060	4·3492	4·3929	4·4371
1·5	4·4817	4·5267	4·5722	4·6182	4·6646	4·7115	4·7588	4·8066	4·8550	4·9037
1·6	4·9530	5·0028	5·0531	5·1039	5·1552	5·2070	5·2593	5·3122	5·3656	5·4195
1·7	5·4739	5·5290	5·5845	5·6407	5·6973	5·7546	5·8124	5·8709	5·9299	5·9895
1·8	6·0496	6·1104	6·1719	6·2339	6·2965	6·3598	6·4237	6·4883	6·5535	6·6194
1·9	6·6859	6·7531	6·8210	6·8895	6·9588	7·0287	7·0993	7·1707	7·2427	7·3155
2·0	7·3891	7·4633	7·5383	7·6141	7·6906	7·7679	7·8460	7·9248	8·0045	8·0849
2·1	8·1662	8·2482	8·3311	8·4149	8·4994	8·5849	8·6711	8·7583	8·8463	8·9352
2·2	9·0250	9·1157	9·2073	9·2999	9·3933	9·4877	9·5831	9·6794	9·7767	9·8749
2·3	9·9742	10·074	10·176	10·278	10·381	10·486	10·591	10·697	10·805	10·913
2·4	11·023	11·134	11·246	11·359	11·473	11·588	11·705	11·822	11·941	12·061
x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09

x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
2·5	12·182	12·305	12·429	12·554	12·680	12·807	12·936	13·066	13·197	13·330
2·6	13·464	13·599	13·736	13·874	14·013	14·154	14·296	14·440	14·585	14·732
2·7	14·880	15·029	15·180	15·333	15·487	15·643	15·800	15·959	16·119	16·281
2·8	16·445	16·610	16·777	16·945	17·116	17·288	17·462	17·637	17·814	17·993
2·9	18·174	18·357	18·541	18·728	18·916	19·106	19·298	19·492	19·688	19·886
3·0	20·086	20·287	20·491	20·697	20·905	21·115	21·327	21·542	21·758	21·977
3·1	22·198	22·421	22·646	22·874	23·104	23·336	23·571	23·808	24·047	24·288
3·2	24·533	24·779	25·028	25·280	25·534	25·790	26·050	26·311	26·576	26·843
3·3	27·113	27·385	27·660	27·938	28·219	28·503	28·789	29·079	29·371	29·666
3·4	29·964	30·265	30·569	30·877	31·187	31·500	31·817	32·137	32·460	32·786
3·5	33·115	33·448	33·784	34·124	34·467	34·813	35·163	35·517	35·874	36·234
3·6	36·598	36·966	37·338	37·713	38·092	38·475	38·861	39·252	39·646	40·045
3·7	40·447	40·854	41·264	41·679	42·098	42·521	42·948	43·380	43·816	44·256
3·8	44·701	45·150	45·604	46·063	46·525	46·993	47·465	47·942	48·424	48·911
3·9	49·402	49·899	50·400	50·907	51·419	51·935	52·457	52·985	53·517	54·055
4·0	54·598									
x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09

x	e^x	x	e^x	x	e^x	x	e^x	x	e^x	x	e^x
4·1	60·340	4·6	99·484	5·1	164·02	5·6	270·43	6·1	445·86	6·6	735·10
4·2	66·686	4·7	109·95	5·2	181·27	5·7	298·87	6·2	492·75	6·7	812·41
4·3	73·700	4·8	121·51	5·3	200·34	5·8	330·30	6·3	544·57	6·8	897·85
4·4	81·451	4·9	134·29	5·4	221·41	5·9	365·04	6·4	601·85	6·9	992·27
4·5	90·017	5·0	148·41	5·5	244·69	6·0	403·43	6·5	665·14	7·0	1096·63

For further values use $\log_{10} e^x = 0·4342945 \times x$; or use Napierian logarithms, see foot of p. 69.

e^{-x}

x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
0·0	1·0000	·9900	·9802	·9704	·9608	·9512	·9418	·9324	·9231	·9139
0·1	0·9048	·8958	·8869	·8781	·8694	·8607	·8521	·8437	·8353	·8270
0·2	0·8187	·8106	·8025	·7945	·7866	·7788	·7711	·7634	·7558	·7483
0·3	0·7408	·7334	·7261	·7189	·7118	·7047	·6977	·6907	·6839	·6771
0·4	0·6703	·6637	·6570	·6505	·6440	·6376	·6313	·6250	·6188	·6126
0·5	0·6065	·6005	·5945	·5886	·5827	·5769	·5712	·5655	·5599	·5543
0·6	0·5488	·5434	·5379	·5326	·5273	·5220	·5169	·5117	·5066	·5016
0·7	0·4966	·4916	·4868	·4819	·4771	·4724	·4677	·4630	·4584	·4538
0·8	0·4493	·4449	·4404	·4360	·4317	·4274	·4232	·4190	·4148	·4107
0·9	0·4066	·4025	·3985	·3946	·3906	·3867	·3829	·3791	·3753	·3716
1·0	0·3679	·3642	·3606	·3570	·3535	·3499	·3465	·3430	·3396	·3362
1·1	0·3329	·3296	·3263	·3230	·3198	·3166	·3135	·3104	·3073	·3042
1·2	0·3012	·2982	·2952	·2923	·2894	·2865	·2837	·2808	·2780	·2753
1·3	0·2725	·2698	·2671	·2645	·2618	·2592	·2567	·2541	·2516	·2491
1·4	0·2466	·2441	·2417	·2393	·2369	·2346	·2322	·2299	·2276	·2254
1·5	0·2231	·2209	·2187	·2165	·2144	·2122	·2101	·2080	·2060	·2039
1·6	0·2019	·1999	·1979	·1959	·1940	·1920	·1901	·1882	·1864	·1845
1·7	0·1827	·1809	·1791	·1773	·1755	·1738	·1720	·1703	·1686	·1670
1·8	0·1653	·1637	·1620	·1604	·1588	·1572	·1557	·1541	·1526	·1511
1·9	0·1496	·1481	·1466	·1451	·1437	·1423	·1409	·1395	·1381	·1367
2·0	0·1353	·1340	·1327	·1313	·1300	·1287	·1275	·1262	·1249	·1237
2·1	0·1225	·1212	·1200	·1188	·1177	·1165	·1153	·1142	·1130	·1119
2·2	0·1108	·1097	·1086	·1075	·1065	·1054	·1044	·1033	·1023	·1013
2·3	0·1003	·0993	·0983	·0973	·0963	·0954	·0944	·0935	·0925	·0916
2·4	0·0907	·0898	·0889	·0880	·0872	·0863	·0854	·0846	·0837	·0829
2·5	0·0821	·0813	·0805	·0797	·0789	·0781	·0773	·0765	·0758	·0750
2·6	0·0743	·0735	·0728	·0721	·0714	·0707	·0699	·0693	·0686	·0679
2·7	0·0672	·0665	·0659	·0652	·0646	·0639	·0633	·0627	·0620	·0614
2·8	0·0608	·0602	·0596	·0590	·0584	·0578	·0573	·0567	·0561	·0556
2·9	0·0550	·0545	·0539	·0534	·0529	·0523	·0518	·0513	·0508	·0503
3·0	0·0498	·0493	·0488	·0483	·0478	·0474	·0469	·0464	·0460	·0455
3·1	0·0450	·0446	·0442	·0437	·0433	·0429	·0424	·0420	·0416	·0412
3·2	0·0408	·0404	·0400	·0396	·0392	·0388	·0384	·0380	·0376	·0373
3·3	0·0369	·0365	·0362	·0358	·0354	·0351	·0347	·0344	·0340	·0337
3·4	0·0334	·0330	·0327	·0324	·0321	·0317	·0314	·0311	·0308	·0305
3·5	0·0302	·0299	·0296	·0293	·0290	·0287	·0284	·0282	·0279	·0276
3·6	0·0273	·0271	·0268	·0265	·0263	·0260	·0257	·0255	·0252	·0250
3·7	0·0247	·0245	·0242	·0240	·0238	·0235	·0233	·0231	·0228	·0226
3·8	0·0224	·0221	·0219	·0217	·0215	·0213	·0211	·0209	·0207	·0204
3·9	0·0202	·0200	·0198	·0196	·0194	·0193	·0191	·0189	·0187	·0185
4·0	0·0183									

e^{-x} may be found from the e^{x} table and the reciprocal table.

$y = e^{1.9054}$, $\log_e y = 3.9054$

$\log_e 10 = 2.3026$

$\overline{\log_e 4.967 = 1.6028}$

$\therefore y = 49.67$

$y = e^{24.2764}$, $\log_e y = 24.2764$

$2 \log_e 10^5 = 23.0258$

$\overline{\log_e 3.492 = 1.2506}$

$\therefore y = 10^{10} \times 3.492$

x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
0·0	0·0000	0·0100	0·0200	0·0300	0·0400	0·0500	0·0600	0·0701	0·0801	0·0901
0·1	0·1002	0·1102	0·1203	0·1304	0·1405	0·1506	0·1607	0·1708	0·1810	0·1911
0·2	0·2013	0·2115	0·2218	0·2320	0·2423	0·2526	0·2629	0·2733	0·2837	0·2941
0·3	0·3045	0·3150	0·3255	0·3360	0·3466	0·3572	0·3678	0·3785	0·3892	0·4000
0·4	0·4108	0·4216	0·4325	0·4434	0·4543	0·4653	0·4764	0·4875	0·4986	0·5098
0·5	0·5211	0·5324	0·5438	0·5552	0·5666	0·5782	0·5897	0·6014	0·6131	0·6248
0·6	0·6367	0·6485	0·6605	0·6725	0·6846	0·6967	0·7090	0·7213	0·7336	0·7461
0·7	0·7586	0·7712	0·7838	0·7966	0·8094	0·8223	0·8353	0·8484	0·8615	0·8748
0·8	0·8881	0·9015	0·9150	0·9286	0·9423	0·9561	0·9700	0·9840	0·9981	1·0122
0·9	1·0265	1·0409	1·0554	1·0700	1·0847	1·0995	1·1144	1·1294	1·1446	1·1598
1·0	1·1752	1·1907	1·2063	1·2220	1·2379	1·2539	1·2700	1·2862	1·3025	1·3190
1·1	1·3356	1·3524	1·3693	1·3863	1·4035	1·4208	1·4382	1·4558	1·4735	1·4914
1·2	1·5095	1·5276	1·5460	1·5645	1·5831	1·6019	1·6209	1·6400	1·6593	1·6788
1·3	1·6984	1·7182	1·7381	1·7583	1·7786	1·7991	1·8198	1·8406	1·8617	1·8829
1·4	1·9043	1·9259	1·9477	1·9697	1·9919	2·0143	2·0369	2·0597	2·0827	2·1059
1·5	2·1293	2·1529	2·1768	2·2008	2·2251	2·2496	2·2743	2·2993	2·3245	2·3499
1·6	2·3756	2·4015	2·4276	2·4540	2·4806	2·5075	2·5346	2·5620	2·5896	2·6175
1·7	2·6456	2·6740	2·7027	2·7317	2·7609	2·7904	2·8202	2·8503	2·8806	2·9112
1·8	2·9422	2·9734	3·0049	3·0367	3·0689	3·1013	3·1340	3·1671	3·2005	3·2341
1·9	3·2682	3·3025	3·3372	3·3722	3·4075	3·4432	3·4792	3·5156	3·5523	3·5894

x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
2·0	3·6269	3·6647	3·7028	3·7413	3·7803	3·8196	3·8593	3·8993	3·9398	3·9806
2·1	4·0219	4·0635	4·1056	4·1480	4·1909	4·2342	4·2779	4·3221	4·3666	4·4116
2·2	4·4571	4·5030	4·5494	4·5962	4·6434	4·6913	4·7394	4·7881	4·8372	4·8868
2·3	4·9370	4·9876	5·0387	5·0903	5·1425	5·1951	5·2483	5·3020	5·3562	5·4109
2·4	5·4662	5·5221	5·5785	5·6354	5·6929	5·7510	5·8097	5·8689	5·9288	5·9892
2·5	6·0502	6·1118	6·1741	6·2369	6·3004	6·3645	6·4293	6·4946	6·5607	6·6274
2·6	6·6947	6·7628	6·8315	6·9008	6·9709	7·0417	7·1132	7·1854	7·2583	7·3319
2·7	7·4063	7·4814	7·5572	7·6338	7·7112	7·7894	7·8683	7·9480	8·0285	8·1098
2·8	8·1919	8·2749	8·3586	8·4432	8·5287	8·6150	8·7021	8·7902	8·8791	8·9689
2·9	9·0596	9·1512	9·2437	9·3371	9·4315	9·5268	9·6231	9·7203	9·8185	9·9177
3·0	10·018	10·119	10·221	10·324	10·429	10·534	10·640	10·748	10·856	10·966
3·1	11·076	11·188	11·301	11·415	11·530	11·647	11·764	11·883	12·003	12·124
3·2	12·246	12·369	12·494	12·620	12·747	12·876	13·006	13·137	13·269	13·403
3·3	13·538	13·674	13·812	13·951	14·092	14·234	14·377	14·522	14·668	14·816
3·4	14·965	15·116	15·268	15·422	15·577	15·734	15·893	16·053	16·214	16·378
3·5	16·543	16·709	16·877	17·047	17·219	17·392	17·567	17·744	17·923	18·103
3·6	18·285	18·470	18·655	18·843	19·033	19·224	19·418	19·613	19·811	20·010
3·7	20·211	20·415	20·620	20·828	21·037	21·249	21·463	21·679	21·897	22·117
3·8	22·339	22·564	22·791	23·020	23·252	23·486	23·722	23·961	24·202	24·445
3·9	24·691	24·939	25·190	25·444	25·700	25·958	26·219	26·483	26·749	27·018
4·0	27·290									
x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09

For further values use sinh $x = \frac{1}{2}(e^x - e^{-x})$.

cosh x

x	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
0·0	1·0000	1·0001	1·0002	1·0005	1·0008	1·0013	1·0018	1·0025	1·0032	1·0041
0·1	1·0050	1·0061	1·0072	1·0085	1·0098	1·0113	1·0128	1·0145	1·0162	1·0181
0·2	1·0201	1·0221	1·0243	1·0266	1·0289	1·0314	1·0340	1·0367	1·0395	1·0423
0·3	1·0453	1·0484	1·0516	1·0549	1·0584	1·0619	1·0655	1·0692	1·0731	1·0770
0·4	1·0811	1·0852	1·0895	1·0939	1·0984	1·1030	1·1077	1·1125	1·1174	1·1225
0·5	1·1276	1·1329	1·1383	1·1438	1·1494	1·1551	1·1609	1·1669	1·1730	1·1792
0·6	1·1855	1·1919	1·1984	1·2051	1·2119	1·2188	1·2258	1·2330	1·2402	1·2476
0·7	1·2552	1·2628	1·2706	1·2785	1·2865	1·2947	1·3030	1·3114	1·3199	1·3286
0·8	1·3374	1·3464	1·3555	1·3647	1·3740	1·3835	1·3932	1·4029	1·4128	1·4229
0·9	1·4331	1·4434	1·4539	1·4645	1·4753	1·4862	1·4973	1·5085	1·5199	1·5314
1·0	1·5431	1·5549	1·5669	1·5790	1·5913	1·6038	1·6164	1·6292	1·6421	1·6552
1·1	1·6685	1·6820	1·6956	1·7093	1·7233	1·7374	1·7517	1·7662	1·7808	1·7957
1·2	1·8107	1·8258	1·8412	1·8568	1·8725	1·8884	1·9045	1·9208	1·9373	1·9540
1·3	1·9709	1·9880	2·0053	2·0228	2·0404	2·0583	2·0764	2·0947	2·1132	2·1320
1·4	2·1509	2·1700	2·1894	2·2090	2·2288	2·2488	2·2691	2·2896	2·3103	2·3312
1·5	2·3524	2·3738	2·3955	2·4174	2·4395	2·4619	2·4845	2·5073	2·5305	2·5538
1·6	2·5775	2·6014	2·6255	2·6499	2·6746	2·6995	2·7247	2·7502	2·7760	2·8020
1·7	2·8283	2·8549	2·8818	2·9090	2·9364	2·9642	2·9922	3·0206	3·0492	3·0782
1·8	3·1075	3·1371	3·1669	3·1971	3·2277	3·2585	3·2897	3·3212	3·3530	3·3852
1·9	3·4177	3·4506	3·4838	3·5173	3·5512	3·5855	3·6201	3·6551	3·6904	3·7261
2·0	3·7622	3·7987	3·8355	3·8727	3·9103	3·9483	3·9867	4·0255	4·0647	4·1043
2·1	4·1443	4·1847	4·2256	4·2669	4·3085	4·3507	4·3932	4·4362	4·4797	4·5236
2·2	4·5679	4·6127	4·6580	4·7037	4·7499	4·7966	4·8437	4·8914	4·9395	4·9881
2·3	5·0372	5·0868	5·1370	5·1876	5·2388	5·2905	5·3427	5·3954	5·4487	5·5026
2·4	5·5569	5·6119	5·6674	5·7235	5·7801	5·8373	5·8951	5·9535	6·0125	6·0721
2·5	6·1323	6·1931	6·2546	6·3166	6·3793	6·4426	6·5066	6·5712	6·6365	6·7024
2·6	6·7690	6·8363	6·9043	6·9729	7·0423	7·1123	7·1831	7·2546	7·3268	7·3998
2·7	7·4735	7·5479	7·6231	7·6991	7·7758	7·8533	7·9316	8·0106	8·0905	8·1712
2·8	8·2527	8·3351	8·4182	8·5022	8·5871	8·6728	8·7594	8·8469	8·9352	9·0244
2·9	9·1146	9·2056	9·2976	9·3905	9·4844	9·5791	9·6749	9·7716	9·8693	9·9680
3·0	10·068	10·168	10·270	10·373	10·477	10·581	10·687	10·794	10·902	11·011
3·1	11·122	11·233	11·345	11·459	11·574	11·689	11·807	11·925	12·044	12·165
3·2	12·287	12·410	12·534	12·660	12·786	12·915	13·044	13·175	13·307	13·440
3·3	13·575	13·711	13·848	13·987	14·127	14·269	14·412	14·556	14·702	14·850
3·4	14·999	15·149	15·301	15·455	15·610	15·766	15·924	16·084	16·245	16·408
3·5	16·573	16·739	16·907	17·077	17·248	17·421	17·596	17·772	17·951	18·131
3·6	18·313	18·497	18·682	18·870	19·059	19·250	19·444	19·639	19·836	20·035
3·7	20·236	20·439	20·644	20·852	21·061	21·272	21·486	21·702	21·919	22·139
3·8	22·362	22·586	22·813	23·042	23·273	23·507	23·743	23·982	24·222	24·466
3·9	24·711	24·959	25·210	25·463	25·719	25·977	26·238	26·502	26·768	27·037
4·0	27·308									

For further values use $\cosh x = \frac{1}{2}(e^x + e^{-x})$.

SQUARES. From 1 to 10

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	0	1	2	3	4	5	6	7	8	9
1·0	1·0000	1·0201	1·0404	1·0609	1·0816	1·1025	1·1236	1·1449	1·1664	1·1881
1·1	1·2100	1·2321	1·2544	1·2769	1·2996	1·3225	1·3456	1·3689	1·3924	1·4161
1·2	1·4400	1·4641	1·4884	1·5129	1·5376	1·5625	1·5876	1·6129	1·6384	1·6641
1·3	1·6900	1·7161	1·7424	1·7689	1·7956	1·8225	1·8496	1·8769	1·9044	1·9321
1·4	1·9600	1·9881	2·0164	2·0449	2·0736	2·1025	2·1316	2·1609	2·1904	2·2201
1·5	2·2500	2·2801	2·3104	2·3409	2·3716	2·4025	2·4336	2·4649	2·4964	2·5281
1·6	2·5600	2·5921	2·6244	2·6569	2·6896	2·7225	2·7556	2·7889	2·8224	2·8561
1·7	2·8900	2·9241	2·9584	2·9929	3·0276	3·0625	3·0976	3·1329	3·1684	3·2041
1·8	3·2400	3·2761	3·3124	3·3489	3·3856	3·4225	3·4596	3·4969	3·5344	3·5721
1·9	3·6100	3·6481	3·6864	3·7249	3·7636	3·8025	3·8416	3·8809	3·9204	3·9601
2·0	4·0000	4·0401	4·0804	4·1209	4·1616	4·2025	4·2436	4·2849	4·3264	4·3681
2·1	4·4100	4·4521	4·4944	4·5369	4·5796	4·6225	4·6656	4·7089	4·7524	4·7961
2·2	4·8400	4·8841	4·9284	4·9729	5·0176	5·0625	5·1076	5·1529	5·1984	5·2441
2·3	5·2900	5·3361	5·3824	5·4289	5·4756	5·5225	5·5696	5·6169	5·6644	5·7121
2·4	5·7600	5·8081	5·8564	5·9049	5·9536	6·0025	6·0516	6·1009	6·1504	6·2001
2·5	6·2500	6·3001	6·3504	6·4009	6·4516	6·5025	6·5536	6·6049	6·6564	6·7081
2·6	6·7600	6·8121	6·8644	6·9169	6·9696	7·0225	7·0756	7·1289	7·1824	7·2361
2·7	7·2900	7·3441	7·3984	7·4529	7·5076	7·5625	7·6176	7·6729	7·7284	7·7841
2·8	7·8400	7·8961	7·9524	8·0089	8·0656	8·1225	8·1796	8·2369	8·2944	8·3521
2·9	8·4100	8·4681	8·5264	8·5849	8·6436	8·7025	8·7616	8·8209	8·8804	8·9401
3·0	9·0000	9·0601	9·1204	9·1809	9·2416	9·3025	9·3636	9·4249	9·4864	9·5481
3·1	9·6100	9·6721	9·7344	9·7969	9·8596	9·9225	9·9856	10·0489	10·1124	10·1761

Mean differences:

	1	2	3	4	5	6	7	8	9
1·0	21	42	63	84	105	126	147	168	189
1·1	23	46	69	92	115	138	161	184	207
1·2	25	50	75	100	125	150	175	200	225
1·3	27	54	81	108	135	162	189	216	243
1·4	29	58	87	116	145	174	203	232	261
1·5	31	62	93	124	155	186	217	248	279
1·6	33	66	99	132	165	198	231	264	297
1·7	35	70	105	140	175	210	245	280	315
1·8	37	74	111	148	185	222	259	296	333
1·9	39	78	117	156	195	234	273	312	351
2·0	41	82	123	164	205	245	287	328	369
2·1	43	86	129	172	215	258	301	344	387
2·2	45	90	135	180	225	270	315	360	405
2·3	47	94	141	188	235	282	329	376	423
2·4	49	98	147	196	245	294	343	392	441
2·5	51	102	153	204	255	306	357	408	459
2·6	53	106	159	212	265	318	371	424	477
2·7	55	110	165	220	275	330	385	440	495
2·8	57	114	171	228	285	342	399	456	513
2·9	59	118	177	236	295	354	413	472	531
3·0	61	122	183	244	305	366	427	488	549
3·1	63	125	188	251	313	376	439	502	564

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	0	1	2	3	4	5	6	7	8	9
3·2	10·240	10·304	10·368	10·433	10·498	10·563	10·628	10·693	10·758	10·824
3·3	10·890	10·956	11·022	11·089	11·156	11·223	11·290	11·357	11·424	11·492
3·4	11·560	11·628	11·696	11·765	11·834	11·903	11·972	12·041	12·110	12·180
3·5	12·250	12·320	12·390	12·461	12·532	12·603	12·674	12·745	12·816	12·888
3·6	12·960	13·032	13·104	13·177	13·250	13·323	13·396	13·469	13·542	13·616
3·7	13·690	13·764	13·838	13·913	13·988	14·063	14·138	14·213	14·288	14·364
3·8	14·440	14·516	14·592	14·669	14·746	14·823	14·900	14·977	15·054	15·132
3·9	15·210	15·288	15·366	15·445	15·524	15·603	15·682	15·761	15·840	15·920
4·0	16·000	16·080	16·160	16·241	16·322	16·403	16·484	16·565	16·646	16·728
4·1	16·810	16·892	16·974	17·057	17·140	17·223	17·306	17·389	17·472	17·556
4·2	17·640	17·724	17·808	17·893	17·978	18·063	18·148	18·233	18·318	18·404
4·3	18·490	18·576	18·662	18·749	18·836	18·923	19·010	19·097	19·184	19·272
4·4	19·360	19·448	19·536	19·625	19·714	19·803	19·892	19·981	20·070	20·160
4·5	20·250	20·340	20·430	20·521	20·612	20·703	20·794	20·885	20·976	21·068
4·6	21·160	21·252	21·344	21·437	21·530	21·623	21·716	21·809	21·902	21·996
4·7	22·090	22·184	22·278	22·373	22·468	22·563	22·658	22·753	22·848	22·944
4·8	23·040	23·136	23·232	23·329	23·426	23·523	23·620	23·717	23·814	23·912
4·9	24·010	24·108	24·206	24·305	24·404	24·503	24·602	24·701	24·800	24·900
5·0	25·000	25·100	25·200	25·301	25·402	25·503	25·604	25·705	25·806	25·908
5·1	26·010	26·112	26·214	26·317	26·420	26·523	26·626	26·729	26·832	26·936
5·2	27·040	27·144	27·248	27·353	27·458	27·563	27·668	27·773	27·878	27·984
5·3	28·090	28·196	28·302	28·409	28·516	28·623	28·730	28·837	28·944	29·052
5·4	29·160	29·268	29·376	29·485	29·594	29·703	29·812	29·921	30·030	30·140

Mean differences:

	1	2	3	4	5	6	7	8	9
3·2	7	13	20	26	33	39	46	52	59
3·3	7	13	20	27	34	40	47	54	60
3·4	7	14	21	28	35	41	48	55	62
3·5	7	15	21	28	36	43	50	57	64
3·6	8	15	22	29	37	44	51	58	66
3·7	8	15	23	30	38	45	53	60	68
3·8	8	16	23	31	39	46	54	62	69
3·9	8	16	24	32	40	47	55	63	71
4·0	8	16	24	32	41	49	57	65	73
4·1	8	17	25	33	41	50	58	66	75
4·2	9	17	26	34	43	51	60	68	77
4·3	9	17	26	35	44	52	61	70	78
4·4	9	18	27	36	45	53	62	71	80
4·5	9	18	27	36	46	55	64	73	82
4·6	10	19	28	37	46	56	65	74	84
4·7	10	19	29	38	48	57	67	76	86
4·8	10	19	29	39	48	58	68	78	87
4·9	10	20	30	40	50	59	69	79	89
5·0	10	20	30	40	51	61	71	81	91
5·1	11	21	31	41	52	62	72	82	93
5·2	11	21	32	42	53	63	74	84	95
5·3	11	21	32	43	54	64	75	86	96
5·4	11	22	33	44	55	65	76	87	98

SQUARES. FROM 1 TO 10

Squares (page 76):

	0	1	2	3	4	5	6	7	8	9
5·5	30·250	30·360	30·470	30·581	30·692	30·803	30·914	31·025	31·136	31·248
5·6	31·360	31·472	31·584	31·697	31·810	31·923	32·036	32·149	32·262	32·376
5·7	32·490	32·604	32·718	32·833	32·948	33·063	33·178	33·293	33·408	33·524
5·8	33·640	33·756	33·872	33·989	34·106	34·223	34·340	34·457	34·574	34·692
5·9	34·810	34·928	35·046	35·165	35·284	35·403	35·522	35·641	35·760	35·880
6·0	36·000	36·120	36·240	36·361	36·482	36·603	36·724	36·845	36·966	37·088
6·1	37·210	37·332	37·454	37·577	37·700	37·823	37·946	38·069	38·192	38·316
6·2	38·440	38·564	38·688	38·813	38·938	39·063	39·188	39·313	39·438	39·564
6·3	39·690	39·816	39·942	40·069	40·196	40·323	40·450	40·577	40·704	40·832
6·4	40·960	41·088	41·216	41·345	41·474	41·603	41·732	41·861	41·990	42·120
6·5	42·250	42·380	42·510	42·641	42·772	42·903	43·034	43·165	43·296	43·428
6·6	43·560	43·692	43·824	43·957	44·090	44·223	44·356	44·489	44·622	44·756
6·7	44·890	45·024	45·158	45·293	45·428	45·563	45·698	45·833	45·968	46·104
6·8	46·240	46·376	46·512	46·649	46·786	46·923	47·060	47·197	47·334	47·472
6·9	47·610	47·748	47·886	48·025	48·164	48·303	48·442	48·581	48·720	48·860
7·0	49·000	49·140	49·280	49·421	49·562	49·703	49·844	49·985	50·126	50·268
7·1	50·410	50·552	50·694	50·837	50·980	51·123	51·266	51·409	51·552	51·696
7·2	51·840	51·984	52·128	52·273	52·418	52·563	52·708	52·853	52·998	53·144
7·3	53·290	53·436	53·582	53·729	53·876	54·023	54·170	54·317	54·464	54·612
7·4	54·760	54·908	55·056	55·205	55·354	55·503	55·652	55·801	55·950	56·100
7·5	56·250	56·400	56·550	56·701	56·852	57·003	57·154	57·305	57·456	57·608
7·6	57·760	57·912	58·064	58·217	58·370	58·523	58·676	58·829	58·982	59·136

Proportional parts (page 76):

	1	2	3	4	5	6	7	8	9
5·5	11	22	33	44	56	67	78	89	100
5·6	11	22	34	45	57	68	79	90	102
5·7	12	23	35	46	58	69	81	92	104
5·8	12	23	35	47	59	70	82	94	105
5·9	12	24	36	48	60	71	83	95	107
6·0	12	24	36	48	61	73	85	97	109
6·1	12	25	37	49	62	74	86	98	111
6·2	13	25	38	50	63	75	88	100	113
6·3	13	25	38	51	64	76	89	102	114
6·4	13	26	39	52	65	77	90	103	116
6·5	13	26	39	52	66	79	92	105	118
6·6	13	27	40	54	67	80	93	106	120
6·7	14	27	41	54	68	81	95	108	122
6·8	14	27	41	55	69	82	96	110	123
6·9	14	28	42	56	70	83	97	111	125
7·0	14	28	42	56	71	85	99	113	127
7·1	15	29	43	57	72	86	100	114	129
7·2	15	29	44	58	73	87	102	116	131
7·3	15	29	44	59	74	88	103	118	132
7·4	15	30	45	60	75	89	104	119	134
7·5	15	30	45	60	76	91	106	121	136
7·6	15	31	46	61	77	92	107	122	138

Squares (page 77):

	0	1	2	3	4	5	6	7	8	9
7·7	59·290	59·444	59·598	59·753	59·908	60·063	60·218	60·373	60·528	60·684
7·8	60·840	60·996	61·152	61·309	61·466	61·623	61·780	61·937	62·094	62·252
7·9	62·410	62·568	62·726	62·885	63·044	63·203	63·362	63·521	63·680	63·840
8·0	64·000	64·160	64·320	64·481	64·642	64·803	64·964	65·125	65·286	65·448
8·1	65·610	65·772	65·934	66·097	66·260	66·423	66·586	66·749	66·912	67·076
8·2	67·240	67·404	67·568	67·733	67·898	68·063	68·228	68·393	68·558	68·724
8·3	68·890	69·056	69·222	69·389	69·556	69·723	69·890	70·057	70·224	70·392
8·4	70·560	70·728	70·896	71·065	71·234	71·403	71·572	71·741	71·910	72·080
8·5	72·250	72·420	72·590	72·761	72·932	73·103	73·274	73·445	73·616	73·788
8·6	73·960	74·132	74·304	74·477	74·650	74·823	74·996	75·169	75·342	75·516
8·7	75·690	75·864	76·038	76·213	76·388	76·563	76·738	76·913	77·088	77·264
8·8	77·440	77·616	77·792	77·969	78·146	78·323	78·500	78·677	78·854	79·032
8·9	79·210	79·388	79·566	79·745	79·924	80·103	80·282	80·461	80·640	80·820
9·0	81·000	81·180	81·360	81·541	81·722	81·903	82·084	82·265	82·446	82·628
9·1	82·810	82·992	83·174	83·357	83·540	83·723	83·906	84·089	84·272	84·456
9·2	84·640	84·824	85·008	85·193	85·378	85·563	85·748	85·933	86·118	86·304
9·3	86·490	86·676	86·862	87·049	87·236	87·423	87·610	87·797	87·984	88·172
9·4	88·360	88·548	88·736	88·925	89·114	89·303	89·492	89·681	89·870	90·060
9·5	90·250	90·440	90·630	90·821	91·012	91·203	91·394	91·585	91·776	91·968
9·6	92·160	92·352	92·544	92·737	92·930	93·123	93·316	93·509	93·702	93·896
9·7	94·090	94·284	94·478	94·673	94·868	95·063	95·258	95·453	95·648	95·844
9·8	96·040	96·236	96·432	96·629	96·826	97·023	97·220	97·417	97·614	97·812
9·9	98·010	98·208	98·406	98·605	98·804	99·003	99·202	99·401	99·600	99·800

Proportional parts (page 77):

	1	2	3	4	5	6	7	8	9
7·7	16	31	47	62	78	93	109	124	140
7·8	16	31	47	63	79	94	110	126	141
7·9	16	32	48	64	80	95	111	127	143
8·0	16	32	48	64	81	97	113	129	145
8·1	16	33	49	65	82	98	114	130	147
8·2	17	33	50	66	83	99	116	132	149
8·3	17	33	50	67	84	100	117	134	150
8·4	17	34	51	68	85	101	118	135	152
8·5	17	34	51	68	86	103	120	137	154
8·6	17	35	52	69	87	104	121	138	156
8·7	18	35	53	70	88	105	123	140	158
8·8	18	35	53	71	89	106	124	142	159
8·9	18	36	54	72	90	107	125	143	161
9·0	18	36	54	72	91	109	127	145	163
9·1	18	37	55	73	92	110	128	146	165
9·2	19	37	56	74	93	111	130	148	167
9·3	19	37	56	75	94	112	131	150	168
9·4	19	38	57	76	95	113	132	151	170
9·5	19	38	57	76	96	115	134	153	172
9·6	19	39	58	77	97	116	135	154	174
9·7	20	39	59	78	98	117	137	156	176
9·8	20	39	59	79	99	118	138	158	177
9·9	20	40	60	80	100	119	139	159	179

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
1·0	1·0000	1·0050	1·0100	1·0149	1·0198	1·0247	1·0296	1·0344	1·0392	1·0440	5	10	15	20	24	29	34	39	44
1·1	1·0488	1·0536	1·0583	1·0630	1·0677	1·0724	1·0770	1·0817	1·0863	1·0909	5	9	14	19	23	28	33	37	42
1·2	1·0954	1·1000	1·1045	1·1091	1·1136	1·1180	1·1225	1·1269	1·1314	1·1358	4	9	13	18	22	27	31	36	40
1·3	1·1402	1·1446	1·1489	1·1533	1·1576	1·1619	1·1662	1·1705	1·1747	1·1790	4	9	13	17	22	26	30	34	39
1·4	1·1832	1·1874	1·1916	1·1958	1·2000	1·2042	1·2083	1·2124	1·2166	1·2207	4	8	13	17	21	25	29	33	37
1·5	1·2247	1·2288	1·2329	1·2369	1·2410	1·2450	1·2490	1·2530	1·2570	1·2610	4	8	12	16	20	24	28	32	36
1·6	1·2649	1·2689	1·2728	1·2767	1·2806	1·2845	1·2884	1·2923	1·2961	1·3000	4	8	12	16	19	23	27	31	35
1·7	1·3038	1·3077	1·3115	1·3153	1·3191	1·3229	1·3266	1·3304	1·3342	1·3379	4	8	11	15	19	23	27	30	34
1·8	1·3416	1·3454	1·3491	1·3528	1·3565	1·3601	1·3638	1·3675	1·3711	1·3748	4	7	11	15	18	22	26	29	33
1·9	1·3784	1·3820	1·3856	1·3892	1·3928	1·3964	1·4000	1·4036	1·4071	1·4107	4	7	11	14	18	22	25	29	32
2·0	1·4142	1·4177	1·4213	1·4248	1·4283	1·4318	1·4353	1·4387	1·4422	1·4457	4	7	11	14	18	21	25	28	31
2·1	1·4491	1·4526	1·4560	1·4595	1·4629	1·4663	1·4697	1·4731	1·4765	1·4799	3	7	10	14	17	20	24	28	31
2·2	1·4832	1·4866	1·4900	1·4933	1·4966	1·5000	1·5033	1·5067	1·5100	1·5133	3	7	10	13	17	20	24	27	30
2·3	1·5166	1·5199	1·5232	1·5264	1·5297	1·5330	1·5362	1·5395	1·5427	1·5460	3	7	10	13	16	20	23	26	30
2·4	1·5492	1·5524	1·5556	1·5588	1·5620	1·5652	1·5684	1·5716	1·5748	1·5780	3	6	10	13	16	19	22	26	29
2·5	1·5811	1·5843	1·5875	1·5906	1·5937	1·5969	1·6000	1·6031	1·6062	1·6093	3	6	9	13	16	19	22	25	28
2·6	1·6125	1·6155	1·6186	1·6217	1·6248	1·6279	1·6310	1·6340	1·6371	1·6401	3	6	9	12	15	18	22	25	28
2·7	1·6432	1·6462	1·6492	1·6523	1·6553	1·6583	1·6613	1·6643	1·6673	1·6703	3	6	9	12	15	18	21	24	27
2·8	1·6733	1·6763	1·6793	1·6823	1·6852	1·6882	1·6912	1·6941	1·6971	1·7000	3	6	9	12	15	18	21	24	27
2·9	1·7029	1·7059	1·7088	1·7117	1·7146	1·7176	1·7205	1·7234	1·7263	1·7292	3	6	9	12	15	18	20	23	26
3·0	1·7321	1·7349	1·7378	1·7407	1·7436	1·7464	1·7493	1·7521	1·7550	1·7578	3	6	9	11	14	17	20	23	26
3·1	1·7607	1·7635	1·7664	1·7692	1·7720	1·7748	1·7776	1·7804	1·7833	1·7861	3	6	9	11	14	17	20	23	25

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
3·2	1·7889	1·7916	1·7944	1·7972	1·8000	1·8028	1·8055	1·8083	1·8111	1·8138	3	5	8	11	14	17	19	22	25
3·3	1·8166	1·8193	1·8221	1·8248	1·8276	1·8303	1·8330	1·8358	1·8385	1·8412	3	5	8	11	14	16	19	22	25
3·4	1·8439	1·8466	1·8493	1·8520	1·8547	1·8574	1·8601	1·8628	1·8655	1·8682	3	5	8	11	13	16	19	22	24
3·5	1·8708	1·8735	1·8762	1·8788	1·8815	1·8841	1·8868	1·8894	1·8921	1·8947	3	5	8	11	13	16	19	21	24
3·6	1·8974	1·9000	1·9026	1·9053	1·9079	1·9105	1·9131	1·9157	1·9183	1·9209	3	5	8	10	13	16	18	21	23
3·7	1·9235	1·9261	1·9287	1·9313	1·9339	1·9365	1·9391	1·9416	1·9442	1·9468	3	5	8	10	13	15	18	21	23
3·8	1·9494	1·9519	1·9545	1·9570	1·9596	1·9621	1·9647	1·9672	1·9698	1·9723	3	5	8	10	13	15	18	20	23
3·9	1·9748	1·9774	1·9799	1·9824	1·9849	1·9875	1·9900	1·9925	1·9950	1·9975	3	5	8	10	12	15	18	20	23
4·0	2·0000	2·0025	2·0050	2·0075	2·0100	2·0125	2·0149	2·0174	2·0199	2·0224	2	5	7	10	12	15	17	20	22
4·1	2·0248	2·0273	2·0298	2·0322	2·0347	2·0372	2·0396	2·0421	2·0445	2·0469	2	5	7	10	12	15	17	20	22
4·2	2·0494	2·0518	2·0543	2·0567	2·0591	2·0616	2·0640	2·0664	2·0688	2·0712	2	5	7	10	12	15	17	19	22
4·3	2·0736	2·0761	2·0785	2·0809	2·0833	2·0857	2·0881	2·0905	2·0928	2·0952	2	5	7	10	12	14	17	19	22
4·4	2·0976	2·1000	2·1024	2·1048	2·1071	2·1095	2·1119	2·1142	2·1166	2·1190	2	5	7	9	12	14	16	19	21
4·5	2·1213	2·1237	2·1260	2·1284	2·1307	2·1331	2·1354	2·1378	2·1401	2·1424	2	5	7	9	11	14	16	19	21
4·6	2·1448	2·1471	2·1494	2·1517	2·1541	2·1564	2·1587	2·1610	2·1633	2·1656	2	5	7	9	12	14	16	18	21
4·7	2·1679	2·1703	2·1726	2·1749	2·1772	2·1794	2·1817	2·1840	2·1863	2·1886	2	5	7	9	11	14	16	18	20
4·8	2·1909	2·1932	2·1954	2·1977	2·2000	2·2023	2·2045	2·2068	2·2091	2·2113	2	5	7	9	11	14	16	18	20
4·9	2·2136	2·2159	2·2181	2·2204	2·2226	2·2249	2·2271	2·2293	2·2316	2·2338	2	5	7	9	11	13	16	18	20
5·0	2·2361	2·2383	2·2405	2·2428	2·2450	2·2472	2·2494	2·2517	2·2539	2·2561	2	4	7	9	11	13	16	18	20
5·1	2·2583	2·2605	2·2627	2·2650	2·2672	2·2694	2·2716	2·2738	2·2760	2·2782	2	4	7	9	11	13	15	18	20
5·2	2·2804	2·2825	2·2847	2·2869	2·2891	2·2913	2·2935	2·2956	2·2978	2·3000	2	4	7	9	11	13	15	17	20
5·3	2·3022	2·3043	2·3065	2·3087	2·3108	2·3130	2·3152	2·3173	2·3195	2·3216	2	4	6	9	11	13	15	17	19
5·4	2·3238	2·3259	2·3281	2·3302	2·3324	2·3345	2·3367	2·3388	2·3409	2·3431	2	4	6	9	11	13	15	17	19

SQUARE ROOTS. From 1 to 10

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
5·5	2·3452	2·3473	2·3495	2·3516	2·3537	2·3558	2·3580	2·3601	2·3622	2·3643	2	4	6	8	11	13	15	17	19
5·6	2·3664	2·3685	2·3707	2·3728	2·3749	2·3770	2·3791	2·3812	2·3833	2·3854	2	4	6	8	11	13	15	17	19
5·7	2·3875	2·3896	2·3917	2·3937	2·3958	2·3979	2·4000	2·4021	2·4042	2·4062	2	4	6	8	11	13	15	17	19
5·8	2·4083	2·4104	2·4125	2·4145	2·4166	2·4187	2·4207	2·4228	2·4249	2·4269	2	4	6	8	10	12	15	16	19
5·9	2·4290	2·4310	2·4331	2·4352	2·4372	2·4393	2·4413	2·4434	2·4454	2·4474	2	4	6	8	10	12	14	16	18
6·0	2·4495	2·4515	2·4536	2·4556	2·4576	2·4597	2·4617	2·4637	2·4658	2·4678	2	4	6	8	10	12	14	16	18
6·1	2·4698	2·4718	2·4739	2·4759	2·4779	2·4799	2·4819	2·4839	2·4860	2·4880	2	4	6	8	10	12	14	16	18
6·2	2·4900	2·4920	2·4940	2·4960	2·4980	2·5000	2·5020	2·5040	2·5060	2·5080	2	4	6	8	10	12	14	16	18
6·3	2·5100	2·5120	2·5140	2·5159	2·5179	2·5199	2·5219	2·5239	2·5259	2·5278	2	4	6	8	10	12	14	16	18
6·4	2·5298	2·5318	2·5338	2·5357	2·5377	2·5397	2·5417	2·5436	2·5456	2·5475	2	4	6	8	10	12	14	16	18
6·5	2·5495	2·5515	2·5534	2·5554	2·5573	2·5593	2·5612	2·5632	2·5652	2·5671	2	4	6	8	10	12	14	16	18
6·6	2·5690	2·5710	2·5729	2·5749	2·5768	2·5788	2·5807	2·5826	2·5846	2·5865	2	4	6	8	10	11	14	16	17
6·7	2·5884	2·5904	2·5923	2·5942	2·5962	2·5981	2·6000	2·6019	2·6038	2·6058	2	4	6	8	10	11	14	15	17
6·8	2·6077	2·6096	2·6115	2·6134	2·6153	2·6173	2·6192	2·6211	2·6230	2·6249	2	4	6	8	10	11	14	15	17
6·9	2·6268	2·6287	2·6306	2·6325	2·6344	2·6363	2·6382	2·6401	2·6420	2·6439	2	4	6	8	9	11	13	15	17
7·0	2·6458	2·6476	2·6495	2·6514	2·6533	2·6552	2·6571	2·6589	2·6608	2·6627	2	4	6	8	9	11	13	15	17
7·1	2·6646	2·6665	2·6683	2·6702	2·6721	2·6739	2·6758	2·6777	2·6796	2·6814	2	4	6	8	9	11	13	15	17
7·2	2·6833	2·6851	2·6870	2·6889	2·6907	2·6926	2·6944	2·6963	2·6981	2·7000	2	4	6	8	9	11	13	15	17
7·3	2·7019	2·7037	2·7055	2·7074	2·7092	2·7111	2·7129	2·7148	2·7166	2·7185	2	4	6	7	9	11	13	15	17
7·4	2·7203	2·7221	2·7240	2·7258	2·7276	2·7295	2·7313	2·7331	2·7350	2·7368	2	4	6	7	9	11	13	15	16
7·5	2·7386	2·7404	2·7423	2·7441	2·7459	2·7477	2·7495	2·7514	2·7532	2·7550	2	4	5	7	9	11	13	15	16
7·6	2·7568	2·7586	2·7604	2·7622	2·7641	2·7659	2·7677	2·7695	2·7713	2·7731	2	4	5	7	9	11	13	14	16

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
7·7	2·7749	2·7767	2·7785	2·7803	2·7821	2·7839	2·7857	2·7875	2·7893	2·7911	2	4	5	7	9	11	13	14	16
7·8	2·7928	2·7946	2·7964	2·7982	2·8000	2·8018	2·8036	2·8054	2·8071	2·8089	2	4	5	7	9	11	13	14	16
7·9	2·8107	2·8125	2·8142	2·8160	2·8178	2·8196	2·8213	2·8231	2·8249	2·8267	2	3	5	7	9	11	12	14	16
8·0	2·8284	2·8302	2·8320	2·8337	2·8355	2·8373	2·8390	2·8408	2·8425	2·8443	2	4	5	7	9	11	12	14	16
8·1	2·8460	2·8478	2·8496	2·8513	2·8531	2·8548	2·8566	2·8583	2·8601	2·8618	2	4	5	7	9	11	12	14	16
8·2	2·8636	2·8653	2·8671	2·8688	2·8705	2·8723	2·8740	2·8758	2·8775	2·8792	2	3	5	7	9	10	12	14	16
8·3	2·8810	2·8827	2·8844	2·8862	2·8879	2·8896	2·8914	2·8931	2·8948	2·8965	2	3	5	7	9	10	12	14	15
8·4	2·8983	2·9000	2·9017	2·9034	2·9052	2·9069	2·9086	2·9103	2·9120	2·9138	2	3	5	7	9	10	12	14	15
8·5	2·9155	2·9172	2·9189	2·9206	2·9223	2·9240	2·9257	2·9275	2·9292	2·9309	2	3	5	7	9	10	12	14	15
8·6	2·9326	2·9343	2·9360	2·9377	2·9394	2·9411	2·9428	2·9445	2·9462	2·9479	2	3	5	7	9	10	12	14	15
8·7	2·9496	2·9513	2·9530	2·9547	2·9563	2·9580	2·9597	2·9614	2·9631	2·9648	2	3	5	7	8	10	12	13	15
8·8	2·9665	2·9682	2·9698	2·9715	2·9732	2·9749	2·9766	2·9783	2·9799	2·9816	2	3	5	7	8	10	12	13	15
8·9	2·9833	2·9850	2·9866	2·9883	2·9900	2·9917	2·9933	2·9950	2·9967	2·9983	2	3	5	7	8	10	12	13	15
9·0	3·0000	3·0017	3·0033	3·0050	3·0067	3·0083	3·0100	3·0116	3·0133	3·0150	2	3	5	7	8	10	12	13	15
9·1	3·0166	3·0183	3·0199	3·0216	3·0232	3·0249	3·0265	3·0282	3·0299	3·0315	2	3	5	7	8	10	11	13	15
9·2	3·0332	3·0348	3·0364	3·0381	3·0397	3·0414	3·0430	3·0447	3·0463	3·0480	2	3	5	7	8	10	11	13	15
9·3	3·0496	3·0512	3·0529	3·0545	3·0561	3·0578	3·0594	3·0610	3·0627	3·0643	2	3	5	7	8	10	11	13	15
9·4	3·0659	3·0676	3·0692	3·0708	3·0725	3·0741	3·0757	3·0773	3·0790	3·0806	2	3	5	7	8	10	11	13	14
9·5	3·0822	3·0838	3·0854	3·0871	3·0887	3·0903	3·0919	3·0935	3·0952	3·0968	2	3	5	6	8	9	11	13	14
9·6	3·0984	3·1000	3·1016	3·1032	3·1048	3·1064	3·1081	3·1097	3·1113	3·1129	2	3	5	6	8	9	11	13	14
9·7	3·1145	3·1161	3·1177	3·1193	3·1209	3·1225	3·1241	3·1257	3·1273	3·1289	2	3	5	6	8	9	11	13	14
9·8	3·1305	3·1321	3·1337	3·1353	3·1369	3·1385	3·1401	3·1417	3·1432	3·1448	2	3	5	6	8	9	11	13	14
9·9	3·1464	3·1480	3·1496	3·1512	3·1528	3·1544	3·1559	3·1575	3·1591	3·1607	2	3	5	6	8	9	11	13	14

SQUARE ROOTS. From 10 to 100

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
10	3·1623	3·1780	3·1937	3·2094	3·2249	3·2404	3·2558	3·2711	3·2863	3·3015	15	31	46	62	77	92	108	123	139
11	3·3166	3·3317	3·3466	3·3615	3·3764	3·3912	3·4059	3·4205	3·4351	3·3496	15	30	44	59	74	89	104	118	133
12	3·4641	3·4785	3·4928	3·5071	3·5214	3·5355	3·5496	3·5637	3·5777	3·5917	14	28	43	57	71	85	99	114	128
13	3·6056	3·6194	3·6332	3·6469	3·6606	3·6742	3·6878	3·7014	3·7148	3·7283	14	27	41	54	68	82	95	109	122
14	3·7417	3·7550	3·7683	3·7815	3·7947	3·8079	3·8210	3·8341	3·8471	3·8601	13	26	39	52	66	79	92	105	118
15	3·8730	3·8859	3·8987	3·9115	3·9243	3·9370	3·9497	3·9623	3·9749	3·9875	13	25	38	51	64	76	89	102	114
16	4·0000	4·0125	4·0249	4·0373	4·0497	4·0620	4·0743	4·0866	4·0988	4·1110	12	25	37	49	62	74	86	98	111
17	4·1231	4·1352	4·1473	4·1593	4·1713	4·1833	4·1952	4·2071	4·2190	4·2308	12	24	36	48	60	72	84	96	108
18	4·2426	4·2544	4·2661	4·2778	4·2895	4·3012	4·3128	4·3243	4·3359	4·3474	11	23	35	46	58	70	81	93	104
19	4·3589	4·3704	4·3818	4·3932	4·4045	4·4159	4·4272	4·4385	4·4497	4·4609	11	23	34	45	57	68	79	90	102
20	4·4721	4·4833	4·4944	4·5056	4·5166	4·5277	4·5387	4·5497	4·5607	4·5717	11	22	33	44	56	67	78	89	100
21	4·5826	4·5935	4·6043	4·6152	4·6260	4·6368	4·6476	4·6583	4·6690	4·6797	11	22	32	43	54	65	76	86	97
22	4·6904	4·7011	4·7117	4·7223	4·7329	4·7434	4·7539	4·7645	4·7749	4·7854	11	21	32	42	53	63	74	84	95
23	4·7958	4·8062	4·8166	4·8270	4·8374	4·8477	4·8580	4·8683	4·8785	4·8888	10	21	31	41	52	62	72	82	93
24	4·8990	4·9092	4·9193	4·9295	4·9396	4·9497	4·9598	4·9699	4·9800	4·9900	10	20	30	40	51	61	71	81	91
25	5·0000	5·0100	5·0200	5·0299	5·0398	5·0498	5·0596	5·0695	5·0794	5·0892	10	20	30	40	50	59	69	79	89
26	5·0990	5·1088	5·1186	5·1284	5·1381	5·1478	5·1575	5·1672	5·1769	5·1865	10	19	29	39	49	58	68	78	87
27	5·1962	5·2058	5·2154	5·2249	5·2345	5·2440	5·2536	5·2631	5·2726	5·2820	10	19	29	38	48	57	67	76	86
28	5·2915	5·3009	5·3104	5·3198	5·3292	5·3385	5·3479	5·3572	5·3666	5·3759	9	19	28	38	47	56	66	75	85
29	5·3852	5·3944	5·4037	5·4129	5·4222	5·4314	5·4406	5·4498	5·4589	5·4681	9	18	28	37	46	55	64	74	83
30	5·4772	5·4863	5·4955	5·5045	5·5136	5·5227	5·5317	5·5408	5·5498	5·5588	9	18	27	36	45	55	64	73	82
31	5·5678	5·5767	5·5857	5·5946	5·6036	5·6125	5·6214	5·6303	5·6391	5·6480	9	18	27	36	45	53	62	71	80

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
32	5·6569	5·6657	5·6745	5·6833	5·6921	5·7009	5·7096	5·7184	5·7271	5·7359	9	18	26	35	44	53	62	70	79
33	5·7446	5·7533	5·7619	5·7706	5·7793	5·7879	5·7966	5·8052	5·8138	5·8224	9	17	26	34	43	52	60	69	77
34	5·8310	5·8395	5·8481	5·8566	5·8652	5·8737	5·8822	5·8907	5·8992	5·9076	9	17	26	34	43	51	60	68	77
35	5·9161	5·9245	5·9330	5·9414	5·9498	5·9582	5·9666	5·9749	5·9833	5·9917	8	17	25	34	42	50	59	67	76
36	6·0000	6·0083	6·0166	6·0249	6·0332	6·0415	6·0498	6·0581	6·0663	6·0745	8	17	25	33	42	50	58	66	75
37	6·0828	6·0910	6·0992	6·1074	6·1156	6·1237	6·1319	6·1400	6·1482	6·1563	8	16	25	33	41	49	57	66	74
38	6·1644	6·1725	6·1806	6·1887	6·1968	6·2048	6·2129	6·2209	6·2290	6·2370	8	16	24	32	41	49	57	65	73
39	6·2450	6·2530	6·2610	6·2690	6·2769	6·2849	6·2929	6·3008	6·3087	6·3166	8	16	24	32	40	48	56	64	72
40	6·3246	6·3325	6·3403	6·3482	6·3561	6·3640	6·3718	6·3797	6·3875	6·3953	8	16	24	32	40	47	55	63	71
41	6·4031	6·4109	6·4187	6·4265	6·4343	6·4420	6·4498	6·4576	6·4653	6·4730	8	16	23	31	39	47	55	62	70
42	6·4807	6·4885	6·4962	6·5038	6·5115	6·5192	6·5269	6·5345	6·5422	6·5498	8	15	23	31	39	46	54	62	69
43	6·5574	6·5651	6·5727	6·5803	6·5879	6·5955	6·6030	6·6106	6·6182	6·6257	8	15	23	30	38	46	53	61	68
44	6·6332	6·6408	6·6483	6·6558	6·6633	6·6708	6·6783	6·6858	6·6933	6·7007	8	15	23	30	38	45	53	60	68
45	6·7082	6·7157	6·7231	6·7305	6·7380	6·7454	6·7528	6·7602	6·7676	6·7750	8	15	22	30	37	44	52	59	67
46	6·7823	6·7897	6·7971	6·8044	6·8118	6·8191	6·8264	6·8337	6·8411	6·8484	7	15	22	29	37	44	51	58	66
47	6·8557	6·8629	6·8702	6·8775	6·8848	6·8920	6·8993	6·9065	6·9138	6·9210	7	15	22	29	37	44	51	58	66
48	6·9282	6·9354	6·9426	6·9498	6·9570	6·9642	6·9714	6·9785	6·9857	6·9929	7	14	22	29	36	43	50	58	65
49	7·0000	7·0071	7·0143	7·0214	7·0285	7·0356	7·0427	7·0498	7·0569	7·0640	7	14	21	28	36	43	50	57	64
50	7·0711	7·0781	7·0852	7·0922	7·0993	7·1063	7·1134	7·1204	7·1274	7·1344	7	14	21	28	35	42	49	56	63
51	7·1414	7·1484	7·1554	7·1624	7·1694	7·1764	7·1833	7·1903	7·1972	7·2042	7	14	21	28	35	42	49	56	63
52	7·2111	7·2180	7·2250	7·2319	7·2388	7·2457	7·2526	7·2595	7·2664	7·2732	7	14	21	28	35	41	48	55	62
53	7·2801	7·2870	7·2938	7·3007	7·3075	7·3144	7·3212	7·3280	7·3348	7·3417	7	14	20	27	34	41	48	55	62
54	7·3485	7·3553	7·3621	7·3689	7·3756	7·3824	7·3892	7·3959	7·4027	7·4095	7	14	20	27	34	41	48	54	61
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

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n	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
55	7·4162	7·4229	7·4297	7·4364	7·4431	7·4498	7·4565	7·4632	7·4699	7·4766	7	13	20	27	34	40	47	54	60
56	7·4833	7·4900	7·4967	7·5033	7·5100	7·5166	7·5233	7·5299	7·5366	7·5432	7	13	20	27	34	40	47	54	60
57	7·5498	7·5565	7·5631	7·5697	7·5763	7·5829	7·5895	7·5961	7·6026	7·6092	7	13	20	27	33	40	46	53	59
58	7·6158	7·6223	7·6289	7·6354	7·6420	7·6485	7·6551	7·6616	7·6681	7·6746	7	13	20	26	33	39	46	53	59
59	7·6811	7·6877	7·6942	7·7006	7·7071	7·7136	7·7201	7·7266	7·7330	7·7395	7	13	20	26	33	39	46	52	59
60	7·7460	7·7524	7·7589	7·7653	7·7717	7·7782	7·7846	7·7910	7·7974	7·8038	6	13	19	26	32	38	45	51	58
61	7·8102	7·8166	7·8230	7·8294	7·8358	7·8422	7·8486	7·8549	7·8613	7·8677	6	13	19	26	32	38	45	51	58
62	7·8740	7·8804	7·8867	7·8930	7·8994	7·9057	7·9120	7·9183	7·9246	7·9310	6	13	19	26	32	38	44	51	57
63	7·9373	7·9436	7·9498	7·9561	7·9624	7·9687	7·9750	7·9812	7·9875	7·9937	6	13	19	25	32	38	44	50	57
64	8·0000	8·0062	8·0125	8·0187	8·0250	8·0312	8·0374	8·0436	8·0498	8·0561	6	12	19	25	31	37	43	50	56
65	8·0623	8·0685	8·0747	8·0808	8·0870	8·0932	8·0994	8·1056	8·1117	8·1179	6	12	19	25	31	37	43	50	56
66	8·1240	8·1302	8·1363	8·1425	8·1486	8·1548	8·1609	8·1670	8·1731	8·1792	6	12	18	24	31	37	43	49	55
67	8·1854	8·1915	8·1976	8·2037	8·2098	8·2158	8·2219	8·2280	8·2341	8·2401	6	12	18	24	31	37	43	49	55
68	8·2462	8·2523	8·2583	8·2644	8·2704	8·2765	8·2825	8·2885	8·2946	8·3006	6	12	18	24	30	36	42	49	54
69	8·3066	8·3126	8·3187	8·3247	8·3307	8·3367	8·3427	8·3487	8·3546	8·3606	6	12	18	24	30	36	42	48	54
70	8·3666	8·3726	8·3785	8·3845	8·3905	8·3964	8·4024	8·4083	8·4143	8·4202	6	12	18	24	30	36	42	48	54
71	8·4261	8·4321	8·4380	8·4439	8·4499	8·4558	8·4617	8·4676	8·4735	8·4794	6	12	18	24	30	35	41	47	53
72	8·4853	8·4912	8·4971	8·5029	8·5088	8·5147	8·5206	8·5264	8·5323	8·5381	6	12	18	24	30	35	41	47	53
73	8·5440	8·5499	8·5557	8·5615	8·5674	8·5732	8·5790	8·5849	8·5907	8·5965	6	12	17	23	29	35	41	46	52
74	8·6023	8·6081	8·6139	8·6197	8·6255	8·6313	8·6371	8·6429	8·6487	8·6545	6	12	17	23	29	35	41	46	52
75	8·6603	8·6660	8·6718	8·6776	8·6833	8·6891	8·6948	8·7006	8·7063	8·7121	6	12	17	23	29	35	40	46	52
76	8·7178	8·7235	8·7293	8·7350	8·7407	8·7464	8·7521	8·7579	8·7636	8·7693	6	11	17	23	29	34	40	46	51

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n	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
77	8·7750	8·7807	8·7864	8·7920	8·7977	8·8034	8·8091	8·8148	8·8204	8·8261	6	11	17	23	29	34	40	46	51
78	8·8318	8·8374	8·8431	8·8487	8·8544	8·8600	8·8657	8·8713	8·8769	8·8826	6	11	17	22	28	34	39	45	50
79	8·8882	8·8938	8·8994	8·9051	8·9107	8·9163	8·9219	8·9275	8·9331	8·9387	6	11	17	22	28	34	39	45	50
80	8·9443	8·9499	8·9554	8·9610	8·9666	8·9722	8·9778	8·9833	8·9889	8·9944	6	11	17	22	28	34	39	45	50
81	9·0000	9·0056	9·0111	9·0167	9·0222	9·0277	9·0333	9·0388	9·0443	9·0499	6	11	17	22	28	33	39	44	50
82	9·0554	9·0609	9·0664	9·0719	9·0774	9·0830	9·0885	9·0940	9·0995	9·1049	6	11	16	22	28	33	39	44	50
83	9·1104	9·1159	9·1214	9·1269	9·1324	9·1378	9·1433	9·1488	9·1542	9·1597	5	11	16	22	27	33	38	44	49
84	9·1652	9·1706	9·1761	9·1815	9·1869	9·1924	9·1978	9·2033	9·2087	9·2141	5	11	16	22	27	32	38	43	49
85	9·2195	9·2250	9·2304	9·2358	9·2412	9·2466	9·2520	9·2574	9·2628	9·2682	5	11	16	22	27	32	38	43	49
86	9·2736	9·2790	9·2844	9·2898	9·2952	9·3005	9·3059	9·3113	9·3167	9·3220	5	11	16	21	27	32	38	43	49
87	9·3274	9·3327	9·3381	9·3434	9·3488	9·3541	9·3595	9·3648	9·3702	9·3755	5	11	16	21	27	32	37	43	48
88	9·3808	9·3862	9·3915	9·3968	9·4021	9·4074	9·4128	9·4181	9·4234	9·4287	5	11	16	21	27	32	37	42	48
89	9·4340	9·4393	9·4446	9·4499	9·4552	9·4604	9·4657	9·4710	9·4763	9·4816	5	11	16	21	26	32	37	42	48
90	9·4868	9·4921	9·4974	9·5026	9·5079	9·5131	9·5184	9·5237	9·5289	9·5341	5	11	16	21	26	32	37	42	48
91	9·5394	9·5446	9·5499	9·5551	9·5603	9·5656	9·5708	9·5760	9·5812	9·5864	5	11	16	21	26	31	36	42	47
92	9·5917	9·5969	9·6021	9·6073	9·6125	9·6177	9·6229	9·6281	9·6333	9·6385	5	10	16	21	26	31	36	42	47
93	9·6437	9·6488	9·6540	9·6592	9·6644	9·6695	9·6747	9·6799	9·6850	9·6902	5	10	15	20	26	31	36	41	47
94	9·6954	9·7005	9·7057	9·7108	9·7160	9·7211	9·7263	9·7314	9·7365	9·7417	5	10	15	20	26	31	36	41	46
95	9·7468	9·7519	9·7570	9·7622	9·7673	9·7724	9·7775	9·7826	9·7877	9·7929	5	10	15	20	26	31	36	41	46
96	9·7980	9·8031	9·8082	9·8133	9·8184	9·8234	9·8285	9·8336	9·8387	9·8438	5	10	15	20	25	31	36	41	46
97	9·8489	9·8539	9·8590	9·8641	9·8691	9·8742	9·8793	9·8843	9·8894	9·8944	5	10	15	20	25	31	36	41	46
98	9·8995	9·9045	9·9096	9·9146	9·9197	9·9247	9·9298	9·9348	9·9398	9·9448	5	10	15	20	25	30	35	40	45
99	9·9499	9·9549	9·9599	9·9649	9·9700	9·9750	9·9800	9·9850	9·9900	9·9950	5	10	15	20	25	30	35	40	45

	0	1	2	3	4	5	6	7	8	9
1·0	1·0000	1·0303	1·0612	1·0927	1·1249	1·1576	1·1910	1·2250	1·2597	1·2950
1·1	1·3310	1·3676	1·4049	1·4429	1·4815	1·5209	1·5609	1·6016	1·6430	1·6852
1·2	1·7280	1·7716	1·8158	1·8609	1·9066	1·9531	2·0004	2·0484	2·0972	2·1467
1·3	2·1970	2·2481	2·3000	2·3526	2·4061	2·4604	2·5155	2·5714	2·6281	2·6856
1·4	2·7440	2·8032	2·8633	2·9242	2·9860	3·0486	3·1121	3·1765	3·2418	3·3079
1·5	3·3750	3·4430	3·5118	3·5816	3·6523	3·7239	3·7964	3·8699	3·9443	4·0197
1·6	4·0960	4·1733	4·2515	4·3307	4·4109	4·4921	4·5743	4·6575	4·7416	4·8268
1·7	4·9130	5·0002	5·0884	5·1777	5·2680	5·3594	5·4518	5·5452	5·6398	5·7353
1·8	5·8320	5·9297	6·0286	6·1285	6·2295	6·3316	6·4349	6·5392	6·6447	6·7513
1·9	6·8590	6·9679	7·0779	7·1891	7·3014	7·4149	7·5295	7·6454	7·7624	7·8806
2·0	8·0000	8·1206	8·2424	8·3654	8·4897	8·6151	8·7418	8·8697	8·9989	9·1293
2·1	9·2610	9·3939	9·5281	9·6636	9·8003	9·9384	10·078	10·218	10·360	10·503
2·2	10·648	10·794	10·941	11·090	11·239	11·391	11·543	11·697	11·852	12·009
2·3	12·167	12·326	12·487	12·649	12·813	12·978	13·144	13·312	13·481	13·652
2·4	13·824	13·998	14·172	14·349	14·527	14·706	14·887	15·069	15·253	15·438
2·5	15·625	15·813	16·003	16·194	16·387	16·581	16·777	16·975	17·174	17·374
2·6	17·576	17·780	17·985	18·191	18·400	18·610	18·821	19·034	19·249	19·465
2·7	19·683	19·903	20·124	20·346	20·571	20·797	21·025	21·254	21·485	21·718
2·8	21·952	22·188	22·426	22·665	22·906	23·149	23·394	23·640	23·888	24·138
2·9	24·389	24·642	24·897	25·154	25·412	25·672	25·934	26·198	26·464	26·731
3·0	27·000	27·271	27·544	27·818	28·094	28·373	28·653	28·934	29·218	29·504
3·1	29·791	30·080	30·371	30·664	30·959	31·256	31·554	31·855	32·157	32·462

	0	1	2	3	4	5	6	7	8	9
3·2	32·768	33·076	33·386	33·698	34·012	34·328	34·646	34·966	35·288	35·611
3·3	35·937	36·265	36·594	36·926	37·260	37·595	37·933	38·273	38·614	38·958
3·4	39·304	39·652	40·002	40·354	40·708	41·064	41·422	41·782	42·144	42·509
3·5	42·875	43·244	43·614	43·987	44·362	44·739	45·118	45·499	45·883	46·268
3·6	46·656	47·046	47·438	47·832	48·229	48·627	49·028	49·431	49·836	50·243
3·7	50·653	51·065	51·479	51·895	52·314	52·734	53·157	53·583	54·010	54·440
3·8	54·872	55·306	55·743	56·182	56·623	57·067	57·512	57·961	58·411	58·864
3·9	59·319	59·776	60·236	60·698	61·163	61·630	62·099	62·571	63·045	63·521
4·0	64·000	64·481	64·965	65·451	65·939	66·430	66·923	67·419	67·917	68·418
4·1	68·921	69·427	69·935	70·445	70·958	71·473	71·991	72·512	73·035	73·560
4·2	74·088	74·618	75·151	75·687	76·225	76·766	77·309	77·854	78·403	78·954
4·3	79·507	80·063	80·622	81·183	81·747	82·313	82·882	83·453	84·028	84·605
4·4	85·184	85·766	86·351	86·938	87·528	88·121	88·717	89·315	89·915	90·519
4·5	91·125	91·734	92·345	92·960	93·577	94·196	94·819	95·444	96·072	96·703
4·6	97·336	97·972	98·611	99·253	99·897	100·54	101·19	101·85	102·50	103·16
4·7	103·82	104·49	105·15	105·82	106·50	107·17	107·85	108·53	109·22	109·90
4·8	110·59	111·28	111·98	112·68	113·38	114·08	114·79	115·50	116·21	116·93
4·9	117·65	118·37	119·10	119·82	120·55	121·29	122·02	122·76	123·51	124·25
5·0	125·00	125·75	126·51	127·26	128·02	128·79	129·55	130·32	131·10	131·87
5·1	132·65	133·43	134·22	135·01	135·80	136·59	137·39	138·19	138·99	139·80
5·2	140·61	141·42	142·24	143·06	143·88	144·70	145·53	146·36	147·20	148·04
5·3	148·88	149·72	150·57	151·42	152·27	153·13	153·99	154·85	155·72	156·59
5·4	157·46	158·34	159·22	160·10	160·99	161·88	162·77	163·67	164·57	165·47

	0	1	2	3	4	5	6	7	8	9
5·5	166·38	167·28	168·20	169·11	170·03	170·95	171·88	172·81	173·74	174·68
5·6	175·62	176·56	177·50	178·45	179·41	180·36	181·32	182·28	183·25	184·22
5·7	185·19	186·17	187·15	188·13	189·12	190·11	191·10	192·10	193·10	194·10
5·8	195·11	196·12	197·14	198·16	199·18	200·20	201·23	202·26	203·30	204·34
5·9	205·37	206·43	207·47	208·53	209·58	210·64	211·71	212·78	213·85	214·92
6·0	216·00	217·08	218·17	219·26	220·35	221·45	222·55	223·65	224·76	225·87
6·1	226·98	228·10	229·22	230·35	231·48	232·61	233·74	234·89	236·03	237·18
6·2	238·33	239·48	240·64	241·80	242·97	244·14	245·31	246·49	247·67	248·86
6·3	250·05	251·24	252·44	253·64	254·84	256·05	257·26	258·47	259·69	260·92
6·4	262·14	263·37	264·61	265·85	267·09	268·34	269·59	270·84	272·10	273·36
6·5	274·63	275·89	277·17	278·45	279·73	281·01	282·30	283·59	284·89	286·19
6·6	287·50	288·80	290·12	291·43	292·75	294·08	295·41	296·74	298·08	299·42
6·7	300·76	302·11	303·46	304·82	306·18	307·55	308·92	310·29	311·67	313·05
6·8	314·43	315·82	317·21	318·61	320·01	321·42	322·83	324·24	325·66	327·08
6·9	328·51	329·94	331·37	332·81	334·26	335·70	337·15	338·61	340·07	341·53
7·0	343·00	344·47	345·95	347·43	348·91	350·40	351·90	353·39	354·89	356·40
7·1	357·91	359·43	360·94	362·47	363·99	365·53	367·06	368·60	370·15	371·69
7·2	373·25	374·81	376·37	377·93	379·50	381·08	382·66	384·24	385·83	387·42
7·3	389·02	390·62	392·22	393·83	395·45	397·07	398·69	400·32	401·95	403·58
7·4	405·22	406·87	408·52	410·17	411·83	413·49	415·16	416·83	418·51	420·19
7·5	421·88	423·56	425·26	426·96	428·66	430·37	432·08	433·80	435·52	437·25
7·6	438·98	440·71	442·45	444·19	445·94	447·70	449·46	451·22	452·98	454·76

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	0	1	2	3	4	5	6	7	8	9
7·7	456·53	458·31	460·10	461·89	463·68	465·48	467·29	469·10	470·91	472·73
7·8	474·55	476·38	478·21	480·05	481·89	483·74	485·59	487·44	489·30	491·17
7·9	493·04	494·91	496·79	498·68	500·57	502·46	504·36	506·26	508·17	510·08
8·0	512·00	513·92	515·85	517·78	519·72	521·66	523·61	525·56	527·51	529·48
8·1	531·44	533·41	535·39	537·37	539·35	541·34	543·34	545·34	547·34	549·35
8·2	551·37	553·39	555·41	557·44	559·48	561·52	563·56	565·61	567·66	569·72
8·3	571·79	573·86	575·93	578·01	580·09	582·18	584·28	586·38	588·48	590·59
8·4	592·70	594·82	596·95	599·09	601·21	603·35	605·50	607·65	609·80	611·96
8·5	614·12	616·30	618·47	620·65	622·84	625·03	627·22	629·42	631·63	633·84
8·6	636·06	638·28	640·50	642·74	644·97	647·21	649·46	651·71	653·97	656·23
8·7	658·50	660·78	663·05	665·34	667·63	669·92	672·22	674·53	676·84	679·15
8·8	681·47	683·80	686·13	688·47	690·81	693·15	695·51	697·86	700·23	702·60
8·9	704·97	707·35	709·73	712·12	714·52	716·92	719·32	721·73	724·15	726·57
9·0	729·00	731·43	733·87	736·31	738·76	741·22	743·68	746·14	748·61	751·09
9·1	753·57	756·06	758·55	761·05	763·55	766·06	768·58	771·10	773·62	776·15
9·2	778·69	781·23	783·78	786·33	788·89	791·45	794·02	796·60	799·18	801·77
9·3	804·36	806·95	809·56	812·17	814·78	817·40	820·03	822·66	825·29	827·94
9·4	830·58	833·24	835·90	838·56	841·23	843·91	846·59	849·28	851·97	854·67
9·5	857·38	860·09	862·80	865·52	868·25	870·98	873·72	876·47	879·22	881·97
9·6	884·74	887·50	890·28	893·06	895·84	898·63	901·43	904·23	907·04	909·85
9·7	912·67	915·50	918·33	921·17	924·01	926·86	929·71	932·57	935·44	938·31
9·8	941·19	944·08	946·97	949·86	952·76	955·67	958·59	961·50	964·43	967·36
9·9	970·30	973·24	976·19	979·15	982·11	985·07	988·05	991·03	994·01	997·00
	0	1	2	3	4	5	6	7	8	9

	0	1	2	3	4	5	6	7	8	9
1·0	1·0000	1·0033	1·0066	1·0099	1·0132	1·0164	1·0196	1·0228	1·0260	1·0291
1·1	1·0323	1·0354	1·0385	1·0416	1·0446	1·0477	1·0507	1·0537	1·0567	1·0597
1·2	1·0627	1·0656	1·0685	1·0714	1·0743	1·0772	1·0801	1·0829	1·0858	1·0886
1·3	1·0914	1·0942	1·0970	1·0997	1·1025	1·1052	1·1079	1·1106	1·1133	1·1160
1·4	1·1187	1·1213	1·1240	1·1266	1·1292	1·1319	1·1344	1·1370	1·1396	1·1422
1·5	1·1447	1·1473	1·1498	1·1523	1·1548	1·1573	1·1598	1·1623	1·1647	1·1672
1·6	1·1696	1·1720	1·1745	1·1769	1·1793	1·1817	1·1840	1·1864	1·1888	1·1911
1·7	1·1935	1·1958	1·1981	1·2005	1·2028	1·2051	1·2074	1·2096	1·2119	1·2142
1·8	1·2164	1·2187	1·2209	1·2232	1·2254	1·2276	1·2298	1·2320	1·2342	1·2364
1·9	1·2386	1·2407	1·2429	1·2450	1·2472	1·2493	1·2515	1·2536	1·2557	1·2578
2·0	1·2599	1·2620	1·2641	1·2662	1·2683	1·2703	1·2724	1·2745	1·2765	1·2785
2·1	1·2806	1·2826	1·2846	1·2866	1·2887	1·2907	1·2927	1·2947	1·2966	1·2986
2·2	1·3006	1·3026	1·3045	1·3065	1·3084	1·3104	1·3123	1·3142	1·3162	1·3181
2·3	1·3200	1·3219	1·3238	1·3257	1·3276	1·3295	1·3314	1·3333	1·3351	1·3370
2·4	1·3389	1·3407	1·3426	1·3444	1·3463	1·3481	1·3499	1·3518	1·3536	1·3554
2·5	1·3572	1·3590	1·3608	1·3626	1·3644	1·3662	1·3680	1·3698	1·3715	1·3733
2·6	1·3751	1·3768	1·3786	1·3803	1·3821	1·3838	1·3856	1·3873	1·3890	1·3908
2·7	1·3925	1·3942	1·3959	1·3976	1·3993	1·4010	1·4027	1·4044	1·4061	1·4078
2·8	1·4095	1·4111	1·4128	1·4145	1·4161	1·4178	1·4195	1·4211	1·4228	1·4244
2·9	1·4260	1·4277	1·4293	1·4309	1·4326	1·4342	1·4358	1·4374	1·4390	1·4406
3·0	1·4422	1·4439	1·4454	1·4470	1·4486	1·4502	1·4518	1·4534	1·4550	1·4565
3·1	1·4581	1·4597	1·4612	1·4628	1·4643	1·4659	1·4674	1·4690	1·4705	1·4721

Mean differences:

	1	2	3	4	5	6	7	8	9
1·0	3	6	10	13	16	19	23	26	29
1·1	3	6	9	12	15	18	21	24	27
1·2	3	6	9	11	14	17	20	23	26
1·3	3	5	8	11	14	17	19	22	25
1·4	3	5	8	10	13	16	18	21	23
1·5	2	5	7	10	12	15	17	20	22
1·6	2	5	7	10	12	14	17	19	22
1·7	2	5	7	9	11	14	16	18	21
1·8	2	4	7	9	11	13	16	18	20
1·9	2	4	6	9	11	13	15	17	19
2·0	2	4	6	8	10	12	14	17	19
2·1	2	4	6	8	10	12	14	16	18
2·2	2	4	6	8	10	12	14	16	17
2·3	2	4	6	8	9	11	13	15	17
2·4	2	4	5	7	9	11	13	15	17
2·5	2	4	5	7	9	11	13	14	16
2·6	2	3	5	7	9	10	12	14	16
2·7	2	3	5	7	8	10	12	14	15
2·8	2	3	5	7	8	10	11	13	15
2·9	2	3	5	6	8	10	11	13	15
3·0	2	3	5	6	8	10	11	13	14
3·1	2	3	5	6	8	9	11	12	14

	0	1	2	3	4	5	6	7	8	9
3·2	1·4736	1·4751	1·4767	1·4782	1·4797	1·4812	1·4828	1·4843	1·4858	1·4873
3·3	1·4888	1·4903	1·4918	1·4933	1·4948	1·4963	1·4978	1·4993	1·5007	1·5022
3·4	1·5037	1·5052	1·5066	1·5081	1·5096	1·5110	1·5125	1·5139	1·5154	1·5168
3·5	1·5183	1·5197	1·5212	1·5226	1·5241	1·5255	1·5269	1·5283	1·5298	1·5312
3·6	1·5326	1·5340	1·5355	1·5369	1·5383	1·5397	1·5411	1·5425	1·5439	1·5453
3·7	1·5467	1·5481	1·5495	1·5508	1·5522	1·5536	1·5550	1·5564	1·5577	1·5591
3·8	1·5605	1·5619	1·5632	1·5646	1·5659	1·5673	1·5687	1·5700	1·5714	1·5727
3·9	1·5741	1·5754	1·5767	1·5781	1·5794	1·5808	1·5821	1·5834	1·5848	1·5861
4·0	1·5874	1·5887	1·5900	1·5914	1·5927	1·5940	1·5953	1·5966	1·5979	1·5992
4·1	1·6005	1·6018	1·6031	1·6044	1·6057	1·6070	1·6083	1·6096	1·6109	1·6121
4·2	1·6134	1·6147	1·6160	1·6173	1·6185	1·6198	1·6211	1·6223	1·6236	1·6249
4·3	1·6261	1·6274	1·6287	1·6299	1·6312	1·6324	1·6337	1·6349	1·6362	1·6374
4·4	1·6386	1·6399	1·6411	1·6424	1·6436	1·6448	1·6461	1·6473	1·6485	1·6497
4·5	1·6510	1·6522	1·6534	1·6546	1·6558	1·6571	1·6583	1·6595	1·6607	1·6619
4·6	1·6631	1·6643	1·6655	1·6667	1·6679	1·6691	1·6703	1·6715	1·6727	1·6739
4·7	1·6751	1·6763	1·6774	1·6786	1·6798	1·6810	1·6822	1·6833	1·6845	1·6857
4·8	1·6869	1·6880	1·6892	1·6904	1·6915	1·6927	1·6939	1·6950	1·6962	1·6973
4·9	1·6985	1·6997	1·7008	1·7020	1·7031	1·7043	1·7054	1·7065	1·7077	1·7088
5·0	1·7100	1·7111	1·7123	1·7134	1·7145	1·7157	1·7168	1·7179	1·7190	1·7202
5·1	1·7213	1·7224	1·7235	1·7247	1·7258	1·7269	1·7280	1·7291	1·7303	1·7314
5·2	1·7325	1·7336	1·7347	1·7358	1·7369	1·7380	1·7391	1·7402	1·7413	1·7424
5·3	1·7435	1·7446	1·7457	1·7468	1·7479	1·7490	1·7501	1·7512	1·7522	1·7533
5·4	1·7544	1·7555	1·7566	1·7577	1·7587	1·7598	1·7609	1·7620	1·7630	1·7641

Mean differences:

	1	2	3	4	5	6	7	8	9
3·2	2	3	5	6	8	9	11	12	14
3·3	1	3	4	6	7	9	10	12	13
3·4	1	3	4	6	7	9	10	12	13
3·5	1	3	4	6	7	9	10	11	13
3·6	1	3	4	6	7	8	10	11	13
3·7	1	3	4	6	7	8	10	11	12
3·8	1	3	4	5	7	8	10	11	12
3·9	1	3	4	5	7	8	9	11	12
4·0	1	3	4	5	7	8	9	11	12
4·1	1	3	4	5	6	8	9	10	12
4·2	1	3	4	5	6	8	9	10	11
4·3	1	3	4	5	6	8	9	10	11
4·4	1	2	4	5	6	7	9	10	11
4·5	1	2	4	5	6	7	9	10	11
4·6	1	2	3	5	6	7	8	10	11
4·7	1	2	3	5	6	7	8	9	11
4·8	1	2	3	5	6	7	8	9	10
4·9	1	2	3	4	6	7	8	9	10
5·0	1	2	3	4	6	7	8	9	10
5·1	1	2	3	4	5	7	8	9	10
5·2	1	2	3	4	5	6	8	9	10
5·3	1	2	3	4	5	6	8	9	10
5·4	1	2	3	4	5	6	8	9	10

CUBE ROOTS. From 1 to 10

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	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
5·5	1·7652	1·7662	1·7673	1·7684	1·7694	1·7705	1·7716	1·7726	1·7737	1·7748	1	2	3	4	5	6	7	8	10
5·6	1·7758	1·7769	1·7779	1·7790	1·7800	1·7811	1·7821	1·7832	1·7842	1·7853	1	2	3	4	5	6	7	8	9
5·7	1·7863	1·7874	1·7884	1·7894	1·7905	1·7915	1·7926	1·7936	1·7946	1·7957	1	2	3	4	5	6	7	8	9
5·8	1·7967	1·7977	1·7988	1·7998	1·8008	1·8018	1·8029	1·8039	1·8049	1·8059	1	2	3	4	5	6	7	8	9
5·9	1·8070	1·8080	1·8090	1·8100	1·8110	1·8121	1·8131	1·8141	1·8151	1·8161	1	2	3	4	5	6	7	8	9
6·0	1·8171	1·8181	1·8191	1·8201	1·8211	1·8222	1·8232	1·8242	1·8252	1·8262	1	2	3	4	5	6	7	8	9
6·1	1·8272	1·8282	1·8292	1·8302	1·8311	1·8321	1·8331	1·8341	1·8351	1·8361	1	2	3	4	5	6	7	8	9
6·2	1·8371	1·8381	1·8391	1·8400	1·8410	1·8420	1·8430	1·8440	1·8450	1·8459	1	2	3	4	5	6	7	8	9
6·3	1·8469	1·8479	1·8489	1·8498	1·8508	1·8518	1·8528	1·8537	1·8547	1·8557	1	2	3	4	5	6	7	8	9
6·4	1·8566	1·8576	1·8586	1·8595	1·8605	1·8615	1·8624	1·8634	1·8643	1·8653	1	2	3	4	5	6	7	8	9
6·5	1·8663	1·8672	1·8682	1·8691	1·8701	1·8710	1·8720	1·8729	1·8739	1·8748	1	2	3	4	5	6	7	8	9
6·6	1·8758	1·8767	1·8777	1·8786	1·8796	1·8805	1·8814	1·8824	1·8833	1·8843	1	2	3	4	5	6	7	8	8
6·7	1·8852	1·8861	1·8871	1·8880	1·8889	1·8899	1·8908	1·8917	1·8927	1·8936	1	2	3	4	5	6	7	7	8
6·8	1·8945	1·8955	1·8964	1·8973	1·8982	1·8992	1·9001	1·9010	1·9019	1·9029	1	2	3	4	5	6	7	7	8
6·9	1·9038	1·9047	1·9056	1·9065	1·9074	1·9084	1·9093	1·9102	1·9111	1·9120	1	2	3	4	5	5	6	7	8
7·0	1·9129	1·9138	1·9148	1·9157	1·9166	1·9175	1·9184	1·9193	1·9202	1·9211	1	2	3	4	5	5	6	7	8
7·1	1·9220	1·9229	1·9238	1·9247	1·9256	1·9265	1·9274	1·9283	1·9292	1·9301	1	2	3	4	5	5	6	7	8
7·2	1·9310	1·9319	1·9328	1·9337	1·9345	1·9354	1·9363	1·9372	1·9381	1·9390	1	2	3	4	4	5	6	7	8
7·3	1·9399	1·9408	1·9416	1·9425	1·9434	1·9443	1·9452	1·9461	1·9469	1·9478	1	2	3	4	4	5	6	7	8
7·4	1·9487	1·9496	1·9504	1·9513	1·9522	1·9531	1·9539	1·9548	1·9557	1·9566	1	2	3	3	4	5	6	7	8
7·5	1·9574	1·9583	1·9592	1·9600	1·9609	1·9618	1·9626	1·9635	1·9644	1·9652	1	2	3	3	4	5	6	7	8
7·6	1·9661	1·9670	1·9678	1·9687	1·9695	1·9704	1·9713	1·9721	1·9730	1·9738	1	2	3	3	4	5	6	7	8

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	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
7·7	1·9747	1·9755	1·9764	1·9772	1·9781	1·9789	1·9798	1·9806	1·9815	1·9823	1	2	3	3	4	5	6	7	8
7·8	1·9832	1·9840	1·9849	1·9857	1·9866	1·9874	1·9883	1·9891	1·9899	1·9908	1	2	3	3	4	5	6	7	8
7·9	1·9916	1·9925	1·9933	1·9941	1·9950	1·9958	1·9967	1·9975	1·9983	1·9992	1	2	3	3	4	5	6	7	8
8·0	2·0000	2·0008	2·0017	2·0025	2·0033	2·0042	2·0050	2·0058	2·0066	2·0075	1	2	2	3	4	5	6	7	7
8·1	2·0083	2·0091	2·0100	2·0108	2·0116	2·0124	2·0132	2·0141	2·0149	2·0157	1	2	2	3	4	5	6	7	7
8·2	2·0165	2·0173	2·0182	2·0190	2·0198	2·0206	2·0214	2·0223	2·0231	2·0239	1	2	2	3	4	5	6	7	7
8·3	2·0247	2·0255	2·0263	2·0271	2·0279	2·0288	2·0296	2·0304	2·0312	2·0320	1	2	2	3	4	5	6	6	7
8·4	2·0328	2·0336	2·0344	2·0352	2·0360	2·0368	2·0376	2·0384	2·0392	2·0400	1	2	2	3	4	5	6	6	7
8·5	2·0408	2·0416	2·0424	2·0432	2·0440	2·0448	2·0456	2·0464	2·0472	2·0480	1	2	2	3	4	5	6	6	7
8·6	2·0488	2·0496	2·0504	2·0512	2·0520	2·0528	2·0536	2·0543	2·0551	2·0559	1	2	2	3	4	5	6	6	7
8·7	2·0567	2·0575	2·0583	2·0591	2·0599	2·0606	2·0614	2·0622	2·0630	2·0638	1	2	2	3	4	5	6	6	7
8·8	2·0646	2·0653	2·0661	2·0669	2·0677	2·0685	2·0692	2·0700	2·0708	2·0716	1	2	2	3	4	5	5	6	7
8·9	2·0724	2·0731	2·0739	2·0747	2·0755	2·0762	2·0770	2·0778	2·0785	2·0793	1	2	2	3	4	5	5	6	7
9·0	2·0801	2·0809	2·0816	2·0824	2·0832	2·0839	2·0847	2·0855	2·0862	2·0870	1	2	2	3	4	5	5	6	7
9·1	2·0878	2·0885	2·0893	2·0901	2·0908	2·0916	2·0923	2·0931	2·0939	2·0946	1	2	2	3	4	5	5	6	7
9·2	2·0954	2·0961	2·0969	2·0977	2·0984	2·0992	2·0999	2·1007	2·1014	2·1022	1	2	2	3	4	5	5	6	7
9·3	2·1029	2·1037	2·1045	2·1052	2·1060	2·1067	2·1075	2·1082	2·1090	2·1097	1	2	2	3	4	5	5	6	7
9·4	2·1105	2·1112	2·1120	2·1127	2·1134	2·1142	2·1149	2·1157	2·1164	2·1172	1	1	2	3	4	4	5	6	7
9·5	2·1179	2·1187	2·1194	2·1201	2·1209	2·1216	2·1224	2·1231	2·1238	2·1246	1	1	2	3	4	4	5	6	7
9·6	2·1253	2·1261	2·1268	2·1275	2·1283	2·1290	2·1297	2·1305	2·1313	2·1319	1	1	2	3	4	4	5	6	7
9·7	2·1327	2·1334	2·1341	2·1349	2·1356	2·1363	2·1371	2·1378	2·1385	2·1392	1	1	2	3	4	4	5	6	7
9·8	2·1400	2·1407	2·1414	2·1422	2·1429	2·1436	2·1443	2·1451	2·1458	2·1465	1	1	2	3	4	4	5	6	6
9·9	2·1472	2·1480	2·1487	2·1494	2·1501	2·1508	2·1516	2·1523	2·1530	2·1537	1	1	2	3	4	4	5	6	6

No.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9	1	2	3	4	5	6	7	8	9
10	2·1544	2·1616	2·1687	2·1757	2·1828	2·1898	2·1967	2·2036	2·2104	2·2172	7	14	21	28	35	42	49	56	62
11	2·2240	2·2307	2·2374	2·2440	2·2506	2·2571	2·2637	2·2702	2·2766	2·2831	7	13	20	26	33	39	46	52	59
12	2·2894	2·2958	2·3021	2·3084	2·3146	2·3208	2·3270	2·3331	2·3391	2·3453	6	12	18	24	30	35	43	49	55
13	2·3513	2·3573	2·3633	2·3693	2·3752	2·3811	2·3870	2·3928	2·3986	2·4044	6	12	18	23	29	35	43	47	55
14	2·4101	2·4159	2·4216	2·4272	2·4329	2·4385	2·4441	2·4497	2·4552	2·4607	6	11	17	22	28	34	39	45	51
15	2·4662	2·4717	2·4771	2·4825	2·4879	2·4933	2·4987	2·5040	2·5093	2·5146	5	11	16	21	27	32	38	43	48
16	2·5198	2·5251	2·5303	2·5355	2·5407	2·5458	2·5510	2·5561	2·5612	2·5662	5	10	15	21	26	31	36	41	46
17	2·5713	2·5763	2·5813	2·5863	2·5913	2·5962	2·6012	2·6060	2·6110	2·6159	5	10	15	20	25	30	35	39	44
18	2·6207	2·6256	2·6304	2·6352	2·6400	2·6448	2·6495	2·6543	2·6590	2·6637	5	10	14	19	24	29	33	38	43
19	2·6684	2·6731	2·6777	2·6824	2·6870	2·6916	2·6962	2·7008	2·7053	2·7099	5	9	14	18	23	28	32	37	41
20	2·7144	2·7189	2·7234	2·7279	2·7324	2·7369	2·7413	2·7457	2·7501	2·7545	4	9	13	18	22	27	31	36	40
21	2·7589	2·7633	2·7677	2·7720	2·7763	2·7806	2·7849	2·7892	2·7935	2·7978	4	9	13	17	22	26	30	34	39
22	2·8020	2·8063	2·8105	2·8147	2·8189	2·8231	2·8273	2·8314	2·8356	2·8398	4	8	13	17	21	25	29	34	38
23	2·8439	2·8480	2·8521	2·8562	2·8603	2·8643	2·8684	2·8724	2·8765	2·8805	4	8	12	16	20	24	28	32	37
24	2·8845	2·8885	2·8925	2·8965	2·9004	2·9044	2·9083	2·9123	2·9162	2·9201	4	8	12	16	20	24	28	32	36
25	2·9240	2·9279	2·9318	2·9357	2·9395	2·9434	2·9472	2·9511	2·9549	2·9587	4	8	12	15	19	23	27	31	35
26	2·9625	2·9663	2·9701	2·9738	2·9776	2·9814	2·9851	2·9888	2·9926	2·9963	4	8	11	15	19	23	26	30	34
27	3·0000	3·0037	3·0074	3·0111	3·0147	3·0184	3·0221	3·0257	3·0293	3·0330	4	7	11	15	18	22	26	29	34
28	3·0366	3·0402	3·0438	3·0474	3·0510	3·0546	3·0581	3·0617	3·0652	3·0688	3	7	11	14	18	21	25	28	32
29	3·0723	3·0758	3·0794	3·0829	3·0864	3·0899	3·0934	3·0968	3·1003	3·1038	3	7	10	14	17	21	24	27	31
30	3·1072	3·1107	3·1141	3·1176	3·1210	3·1244	3·1278	3·1312	3·1346	3·1380	3	7	10	14	17	21	24	28	31
31	3·1414	3·1448	3·1481	3·1515	3·1548	3·1582	3·1615	3·1648	3·1682	3·1715	3	7	10	13	17	20	23	27	30
	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9	1	2	3	4	5	6	7	8	9

No.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9	1	2	3	4	5	6	7	8	9
32	3·1748	3·1781	3·1814	3·1847	3·1880	3·1913	3·1945	3·1978	3·2010	3·2043	3	7	10	13	16	20	23	26	29
33	3·2075	3·2108	3·2140	3·2172	3·2204	3·2237	3·2269	3·2301	3·2333	3·2364	3	6	10	13	16	20	23	26	29
34	3·2396	3·2428	3·2460	3·2491	3·2522	3·2554	3·2586	3·2617	3·2648	3·2679	3	6	10	13	16	19	22	25	28
35	3·2711	3·2742	3·2773	3·2804	3·2835	3·2866	3·2897	3·2927	3·2958	3·2989	3	6	9	12	15	18	22	25	27
36	3·3019	3·3050	3·3080	3·3111	3·3141	3·3171	3·3202	3·3232	3·3262	3·3292	3	6	9	12	15	18	21	24	27
37	3·3322	3·3352	3·3382	3·3412	3·3442	3·3472	3·3501	3·3531	3·3561	3·3590	3	6	9	12	15	18	21	24	26
38	3·3620	3·3649	3·3679	3·3708	3·3737	3·3767	3·3796	3·3825	3·3854	3·3883	3	6	9	12	14	18	20	23	26
39	3·3912	3·3941	3·3970	3·3999	3·4028	3·4056	3·4085	3·4114	3·4142	3·4171	3	6	9	11	14	17	20	23	26
40	3·4200	3·4228	3·4256	3·4285	3·4313	3·4341	3·4370	3·4398	3·4426	3·4454	3	6	8	11	14	17	20	23	25
41	3·4482	3·4510	3·4538	3·4566	3·4594	3·4622	3·4650	3·4677	3·4705	3·4733	3	6	8	11	14	17	19	23	25
42	3·4760	3·4788	3·4815	3·4843	3·4870	3·4898	3·4925	3·4952	3·4980	3·5007	3	5	8	11	14	16	19	22	25
43	3·5034	3·5061	3·5088	3·5115	3·5142	3·5169	3·5196	3·5223	3·5250	3·5277	3	5	8	11	13	16	19	22	24
44	3·5303	3·5330	3·5357	3·5384	3·5410	3·5437	3·5463	3·5490	3·5516	3·5543	3	5	8	11	13	16	18	21	24
45	3·5569	3·5595	3·5622	3·5648	3·5674	3·5700	3·5726	3·5752	3·5778	3·5805	3	5	8	11	13	16	18	21	23
46	3·5830	3·5856	3·5882	3·5908	3·5934	3·5960	3·5986	3·6011	3·6037	3·6063	3	5	8	11	13	16	18	21	23
47	3·6088	3·6114	3·6139	3·6165	3·6190	3·6216	3·6241	3·6267	3·6292	3·6317	3	5	8	11	13	15	18	21	23
48	3·6342	3·6368	3·6393	3·6418	3·6443	3·6468	3·6493	3·6518	3·6543	3·6568	3	5	8	10	12	15	18	20	23
49	3·6593	3·6618	3·6643	3·6668	3·6692	3·6717	3·6742	3·6766	3·6791	3·6816	2	5	8	10	12	15	17	20	22
50	3·6840	3·6865	3·6889	3·6914	3·6938	3·6963	3·6987	3·7011	3·7036	3·7060	2	5	7	10	12	15	17	20	22
51	3·7084	3·7109	3·7133	3·7157	3·7181	3·7205	3·7229	3·7253	3·7277	3·7301	2	5	7	10	12	15	17	19	22
52	3·7325	3·7349	3·7373	3·7397	3·7421	3·7444	3·7468	3·7492	3·7516	3·7539	2	5	7	10	12	14	17	19	22
53	3·7563	3·7586	3·7610	3·7634	3·7657	3·7681	3·7704	3·7728	3·7751	3·7774	2	5	7	9	12	14	16	19	21
54	3·7798	3·7821	3·7844	3·7868	3·7891	3·7914	3·7937	3·7960	3·7983	3·8006	2	5	7	9	11	14	16	19	21
	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9	1	2	3	4	5	6	7	8	9

	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9	1	2	3	4	5	6	7	8	9
55	3·8030	3·8053	3·8076	3·8099	3·8121	3·8144	3·8167	3·8190	3·8213	3·8236	2	5	7	9	11	14	16	18	21
56	3·8259	3·8281	3·8304	3·8327	3·8350	3·8372	3·8395	3·8417	3·8440	3·8463	2	5	7	9	11	14	16	18	20
57	3·8485	3·8508	3·8530	3·8552	3·8575	3·8597	3·8620	3·8642	3·8664	3·8687	2	4	7	9	11	13	16	18	20
58	3·8709	3·8731	3·8753	3·8775	3·8798	3·8820	3·8842	3·8864	3·8886	3·8908	2	4	7	9	11	13	15	18	20
59	3·8930	3·8952	3·8974	3·8996	3·9018	3·9040	3·9061	3·9083	3·9105	3·9127	2	4	7	9	11	13	15	18	20
60	3·9149	3·9170	3·9192	3·9214	3·9235	3·9257	3·9279	3·9300	3·9322	3·9343	2	4	7	9	11	13	15	17	19
61	3·9365	3·9386	3·9408	3·9429	3·9451	3·9472	3·9494	3·9515	3·9536	3·9558	2	4	6	9	11	13	15	17	19
62	3·9579	3·9600	3·9621	3·9643	3·9664	3·9685	3·9706	3·9727	3·9748	3·9770	2	4	6	9	11	13	15	17	19
63	3·9791	3·9812	3·9833	3·9854	3·9875	3·9896	3·9916	3·9937	3·9958	3·9979	2	4	6	8	11	13	15	17	19
64	4·0000	4·0021	4·0042	4·0062	4·0083	4·0104	4·0125	4·0145	4·0166	4·0187	2	4	6	8	10	12	14	16	18
65	4·0207	4·0228	4·0248	4·0269	4·0290	4·0310	4·0331	4·0351	4·0372	4·0392	2	4	6	8	10	12	14	16	18
66	4·0412	4·0433	4·0453	4·0474	4·0494	4·0514	4·0535	4·0555	4·0575	4·0595	2	4	6	8	10	12	14	16	18
67	4·0615	4·0636	4·0656	4·0676	4·0696	4·0716	4·0736	4·0756	4·0777	4·0797	2	4	6	8	10	12	14	16	18
68	4·0817	4·0837	4·0857	4·0877	4·0896	4·0916	4·0936	4·0956	4·0976	4·0996	2	4	6	8	10	12	14	16	18
69	4·1016	4·1035	4·1055	4·1075	4·1095	4·1115	4·1134	4·1154	4·1174	4·1193	2	4	6	8	10	12	14	16	18
70	4·1213	4·1232	4·1252	4·1272	4·1291	4·1311	4·1330	4·1350	4·1370	4·1389	2	4	6	8	10	12	14	16	18
71	4·1408	4·1428	4·1447	4·1466	4·1486	4·1505	4·1524	4·1544	4·1563	4·1582	2	4	6	8	10	12	14	16	17
72	4·1602	4·1621	4·1640	4·1659	4·1679	4·1698	4·1717	4·1736	4·1755	4·1774	2	4	6	8	10	11	13	15	17
73	4·1793	4·1812	4·1832	4·1851	4·1870	4·1889	4·1908	4·1927	4·1946	4·1964	2	4	6	8	10	11	13	15	17
74	4·1983	4·2002	4·2021	4·2040	4·2059	4·2078	4·2097	4·2115	4·2134	4·2153	2	4	6	8	10	11	13	15	17
75	4·2172	4·2190	4·2209	4·2228	4·2246	4·2265	4·2284	4·2302	4·2321	4·2340	2	4	6	7	9	11	13	15	17
76	4·2358	4·2377	4·2395	4·2414	4·2432	4·2451	4·2469	4·2488	4·2506	4·2525	2	4	6	7	9	11	13	15	17

	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9	1	2	3	4	5	6	7	8	9
77	4·2543	4·2562	4·2580	4·2598	4·2617	4·2635	4·2653	4·2672	4·2690	4·2708	2	4	5	7	9	11	13	15	17
78	4·2727	4·2745	4·2763	4·2781	4·2799	4·2818	4·2836	4·2854	4·2872	4·2890	2	4	5	7	9	11	14	15	16
79	4·2908	4·2927	4·2945	4·2963	4·2981	4·2999	4·3017	4·3035	4·3053	4·3071	2	4	5	7	9	11	14	14	16
80	4·3089	4·3107	4·3125	4·3143	4·3160	4·3178	4·3196	4·3214	4·3232	4·3250	2	4	5	7	9	11	13	14	16
81	4·3267	4·3285	4·3303	4·3321	4·3339	4·3356	4·3374	4·3392	4·3409	4·3427	2	4	5	7	9	11	12	14	16
82	4·3445	4·3462	4·3480	4·3498	4·3515	4·3533	4·3551	4·3568	4·3586	4·3603	2	4	5	7	9	11	12	14	16
83	4·3621	4·3638	4·3656	4·3673	4·3691	4·3708	4·3726	4·3743	4·3760	4·3778	2	3	5	7	9	10	12	14	16
84	4·3795	4·3813	4·3830	4·3847	4·3865	4·3882	4·3899	4·3917	4·3934	4·3951	2	3	5	7	9	10	12	14	16
85	4·3968	4·3986	4·4003	4·4020	4·4037	4·4054	4·4072	4·4089	4·4106	4·4123	2	3	5	7	9	10	12	14	16
86	4·4140	4·4157	4·4174	4·4191	4·4208	4·4225	4·4242	4·4259	4·4276	4·4293	2	3	5	7	8	10	12	14	15
87	4·4310	4·4327	4·4344	4·4361	4·4378	4·4395	4·4412	4·4429	4·4446	4·4462	2	3	5	7	8	10	12	13	15
88	4·4480	4·4496	4·4513	4·4530	4·4547	4·4564	4·4580	4·4597	4·4614	4·4631	2	3	5	7	8	10	12	13	15
89	4·4647	4·4664	4·4681	4·4698	4·4714	4·4731	4·4748	4·4764	4·4781	4·4797	2	3	5	7	8	10	12	13	15
90	4·4814	4·4831	4·4847	4·4864	4·4880	4·4897	4·4913	4·4930	4·4946	4·4963	2	3	5	7	8	10	12	13	15
91	4·4979	4·4996	4·5012	4·5029	4·5045	4·5062	4·5078	4·5094	4·5111	4·5127	2	3	5	7	8	10	11	13	15
92	4·5144	4·5160	4·5176	4·5193	4·5209	4·5225	4·5242	4·5258	4·5274	4·5290	2	3	5	6	8	10	11	13	15
93	4·5307	4·5323	4·5339	4·5355	4·5371	4·5388	4·5404	4·5420	4·5436	4·5452	2	3	5	6	8	10	11	13	14
94	4·5468	4·5484	4·5501	4·5517	4·5533	4·5549	4·5565	4·5581	4·5597	4·5613	2	3	5	6	8	10	11	13	14
95	4·5629	4·5645	4·5661	4·5677	4·5693	4·5709	4·5725	4·5741	4·5757	4·5773	2	3	5	6	8	9	11	12	14
96	4·5789	4·5804	4·5820	4·5836	4·5852	4·5868	4·5884	4·5900	4·5915	4·5931	2	3	5	6	8	9	11	12	14
97	4·5947	4·5963	4·5979	4·5994	4·6010	4·6026	4·6042	4·6057	4·6073	4·6089	2	3	5	6	8	9	11	13	14
98	4·6104	4·6120	4·6136	4·6151	4·6167	4·6183	4·6198	4·6214	4·6229	4·6245	2	3	5	6	8	9	11	13	14
99	4·6261	4·6276	4·6292	4·6307	4·6323	4·6338	4·6354	4·6369	4·6385	4·6400	2	3	5	6	8	9	11	12	14

Cube Roots, 100–1000 (rows 10–31)

	0	1	2	3	4	5	6	7	8	9
10	4·6416	4·6570	4·6723	4·6875	4·7027	4·7177	4·7326	4·7475	4·7622	4·7769
11	4·7914	4·8059	4·8203	4·8346	4·8488	4·8629	4·8770	4·8910	4·9049	4·9187
12	4·9324	4·9461	4·9597	4·9732	4·9866	5·0000	5·0133	5·0265	5·0397	5·0528
13	5·0658	5·0788	5·0916	5·1045	5·1172	5·1299	5·1426	5·1551	5·1676	5·1801
14	5·1925	5·2048	5·2171	5·2293	5·2415	5·2536	5·2656	5·2776	5·2896	5·3015
15	5·3133	5·3251	5·3368	5·3485	5·3601	5·3717	5·3832	5·3947	5·4061	5·4175
16	5·4288	5·4401	5·4514	5·4626	5·4737	5·4848	5·4959	5·5069	5·5178	5·5288
17	5·5397	5·5505	5·5613	5·5721	5·5828	5·5934	5·6041	5·6147	5·6252	5·6357
18	5·6462	5·6567	5·6671	5·6774	5·6877	5·6980	5·7083	5·7185	5·7287	5·7388
19	5·7489	5·7590	5·7690	5·7790	5·7890	5·7989	5·8088	5·8186	5·8285	5·8383
20	5·8480	5·8578	5·8675	5·8771	5·8868	5·8964	5·9059	5·9155	5·9250	5·9345
21	5·9439	5·9533	5·9627	5·9721	5·9814	5·9907	6·0000	6·0092	6·0185	6·0277
22	6·0368	6·0459	6·0550	6·0641	6·0732	6·0822	6·0912	6·1002	6·1091	6·1180
23	6·1269	6·1358	6·1446	6·1534	6·1622	6·1710	6·1797	6·1885	6·1972	6·2058
24	6·2145	6·2231	6·2317	6·2403	6·2488	6·2573	6·2658	6·2743	6·2828	6·2912
25	6·2996	6·3080	6·3164	6·3247	6·3330	6·3413	6·3496	6·3579	6·3661	6·3743
26	6·3825	6·3907	6·3988	6·4070	6·4151	6·4232	6·4312	6·4393	6·4473	6·4553
27	6·4633	6·4713	6·4792	6·4872	6·4951	6·5030	6·5108	6·5187	6·5265	6·5343
28	6·5421	6·5499	6·5577	6·5654	6·5731	6·5808	6·5885	6·5962	6·6039	6·6115
29	6·6191	6·6267	6·6343	6·6419	6·6494	6·6569	6·6644	6·6719	6·6794	6·6869
30	6·6943	6·7018	6·7092	6·7166	6·7240	6·7313	6·7387	6·7460	6·7533	6·7606
31	6·7679	6·7752	6·7824	6·7897	6·7969	6·8041	6·8113	6·8185	6·8256	6·8328

Proportional parts (rows 10–31):

	·1	·2	·3	·4	·5	·6	·7	·8	·9
10	15	30	45	60	75	90	105	120	135
11	14	28	42	56	71	85	99	113	127
12	13	27	40	53	67	80	93	106	120
13	13	25	38	51	64	76	89	102	114
14	12	24	36	48	61	73	85	97	109
15	12	23	35	46	58	70	81	93	104
16	11	22	33	44	56	67	78	89	100
17	11	21	32	43	54	64	75	86	96
18	11	21	31	41	52	62	72	82	93
19	10	20	30	40	50	59	69	79	89
20	10	19	29	38	48	58	67	77	86
21	9	19	28	37	47	56	65	74	84
22	9	18	27	36	45	54	63	72	81
23	9	18	26	35	44	52	62	71	79
24	9	17	26	34	43	51	60	68	77
25	8	17	25	33	42	50	58	66	75
26	8	16	24	32	41	49	57	65	73
27	8	16	24	32	40	47	55	63	71
28	8	15	23	31	38	46	54	62	69
29	8	15	23	30	38	45	53	60	68
30	7	15	22	30	37	44	52	59	67
31	7	14	22	29	36	43	50	58	65

Cube Roots, 100–1000 (rows 32–54)

	0	1	2	3	4	5	6	7	8	9
32	6·8399	6·8470	6·8541	6·8612	6·8683	6·8753	6·8824	6·8894	6·8964	6·9034
33	6·9104	6·9174	6·9244	6·9313	6·9382	6·9451	6·9521	6·9589	6·9658	6·9727
34	6·9795	6·9864	6·9932	7·0000	7·0068	7·0136	7·0203	7·0271	7·0338	7·0406
35	7·0473	7·0540	7·0607	7·0674	7·0740	7·0807	7·0873	7·0940	7·1006	7·1072
36	7·1138	7·1204	7·1269	7·1335	7·1400	7·1466	7·1531	7·1596	7·1661	7·1726
37	7·1791	7·1855	7·1920	7·1984	7·2048	7·2112	7·2177	7·2240	7·2304	7·2368
38	7·2432	7·2495	7·2558	7·2622	7·2685	7·2748	7·2811	7·2874	7·2936	7·2999
39	7·3061	7·3124	7·3186	7·3248	7·3310	7·3372	7·3434	7·3496	7·3558	7·3619
40	7·3681	7·3742	7·3803	7·3864	7·3925	7·3986	7·4047	7·4108	7·4169	7·4229
41	7·4290	7·4350	7·4410	7·4470	7·4530	7·4590	7·4650	7·4710	7·4770	7·4829
42	7·4889	7·4948	7·5007	7·5067	7·5126	7·5185	7·5244	7·5302	7·5361	7·5420
43	7·5478	7·5537	7·5595	7·5654	7·5712	7·5770	7·5828	7·5886	7·5944	7·6001
44	7·6059	7·6117	7·6174	7·6232	7·6289	7·6346	7·6403	7·6460	7·6517	7·6574
45	7·6631	7·6688	7·6744	7·6801	7·6857	7·6914	7·6970	7·7026	7·7082	7·7138
46	7·7194	7·7250	7·7306	7·7362	7·7418	7·7473	7·7529	7·7584	7·7639	7·7695
47	7·7750	7·7805	7·7860	7·7915	7·7970	7·8025	7·8079	7·8134	7·8188	7·8243
48	7·8297	7·8352	7·8406	7·8460	7·8514	7·8568	7·8622	7·8676	7·8730	7·8784
49	7·8837	7·8891	7·8944	7·8998	7·9051	7·9105	7·9158	7·9211	7·9264	7·9317
50	7·9370	7·9423	7·9476	7·9528	7·9581	7·9634	7·9686	7·9739	7·9791	7·9843
51	7·9896	7·9948	8·0000	8·0052	8·0104	8·0156	8·0208	8·0260	8·0311	8·0363
52	8·0415	8·0466	8·0517	8·0569	8·0620	8·0671	8·0723	8·0774	8·0825	8·0876
53	8·0927	8·0978	8·1028	8·1079	8·1130	8·1180	8·1231	8·1281	8·1332	8·1382
54	8·1433	8·1483	8·1533	8·1583	8·1633	8·1683	8·1733	8·1783	8·1833	8·1882

Proportional parts (rows 32–54):

	·1	·2	·3	·4	·5	·6	·7	·8	·9
32	7	14	21	28	36	43	50	57	64
33	7	14	21	28	35	41	48	55	62
34	7	14	20	27	34	41	48	54	61
35	7	13	20	27	34	40	47	54	60
36	7	13	20	26	33	39	46	52	59
37	6	13	19	26	32	38	45	51	58
38	6	13	19	25	32	38	44	51	57
39	6	12	19	25	31	37	43	50	56
40	6	12	18	24	31	37	43	49	55
41	6	12	18	24	30	36	42	48	54
42	6	12	18	24	29	35	41	47	53
43	6	12	18	23	29	34	41	46	52
44	6	11	17	23	28	34	40	46	51
45	6	11	17	22	28	34	39	45	50
46	5	11	17	22	28	33	39	45	50
47	5	11	17	22	27	33	39	44	50
48	5	11	16	21	27	32	38	43	49
49	5	11	16	21	26	32	37	42	48
50	5	11	16	21	26	32	37	42	48
51	5	10	16	21	26	31	36	42	47
52	5	10	15	20	26	31	36	41	46
53	5	10	15	20	25	31	36	41	46
54	5	10	15	20	25	30	35	40	45

	0	1	2	3	4	5	6	7	8	9	·1	·2	·3	·4	·5	·6	·7	·8	·9
55	8·1932	8·1982	8·2031	8·2081	8·2130	8·2180	8·2229	8·2278	8·2327	8·2377	5	10	15	20	25	29	34	39	44
56	8·2426	8·2475	8·2524	8·2573	8·2621	8·2670	8·2719	8·2768	8·2816	8·2865	5	10	15	20	25	29	34	39	44
57	8·2913	8·2962	8·3010	8·3059	8·3107	8·3155	8·3203	8·3251	8·3300	8·3348	5	10	14	19	24	29	34	38	43
58	8·3396	8·3443	8·3491	8·3539	8·3587	8·3634	8·3682	8·3730	8·3777	8·3825	5	10	14	19	24	29	34	38	43
59	8·3872	8·3919	8·3967	8·4014	8·4061	8·4108	8·4155	8·4202	8·4249	8·4296	5	10	14	19	24	28	33	38	42
60	8·4343	8·4390	8·4437	8·4484	8·4530	8·4577	8·4623	8·4670	8·4716	8·4763	5	9	14	19	24	28	33	38	42
61	8·4809	8·4856	8·4902	8·4948	8·4994	8·5040	8·5086	8·5132	8·5178	8·5224	5	9	14	18	23	28	32	37	41
62	8·5270	8·5316	8·5362	8·5408	8·5453	8·5499	8·5544	8·5590	8·5635	8·5681	5	9	14	18	23	28	32	37	41
63	8·5726	8·5772	8·5817	8·5862	8·5907	8·5952	8·5997	8·6043	8·6088	8·6132	5	9	14	18	23	27	32	36	41
64	8·6177	8·6222	8·6267	8·6312	8·6357	8·6401	8·6446	8·6490	8·6535	8·6579	5	9	14	18	23	27	32	36	41
65	8·6624	8·6668	8·6713	8·6757	8·6801	8·6845	8·6890	8·6934	8·6978	8·7022	4	9	13	18	22	26	31	35	40
66	8·7066	8·7110	8·7154	8·7198	8·7241	8·7285	8·7329	8·7373	8·7416	8·7460	4	9	13	17	22	26	31	35	40
67	8·7503	8·7547	8·7590	8·7634	8·7677	8·7721	8·7764	8·7807	8·7850	8·7893	4	9	13	17	22	26	30	34	39
68	8·7937	8·7980	8·8023	8·8066	8·8109	8·8152	8·8194	8·8237	8·8280	8·8323	4	9	13	17	22	25	30	34	39
69	8·8366	8·8408	8·8451	8·8493	8·8536	8·8578	8·8621	8·8663	8·8706	8·8748	4	9	13	17	21	25	30	34	38
70	8·8790	8·8833	8·8875	8·8917	8·8959	8·9001	8·9043	8·9085	8·9127	8·9169	4	8	13	17	21	25	30	34	38
71	8·9211	8·9253	8·9295	8·9337	8·9378	8·9420	8·9462	8·9503	8·9545	8·9587	4	8	13	17	21	25	29	33	38
72	8·9628	8·9670	8·9711	8·9752	8·9794	8·9835	8·9876	8·9918	8·9959	9·0000	4	8	12	17	21	25	29	33	37
73	9·0041	9·0082	9·0123	9·0164	9·0205	9·0246	9·0287	9·0328	9·0369	9·0410	4	8	12	16	21	25	29	33	37
74	9·0450	9·0491	9·0532	9·0572	9·0613	9·0654	9·0694	9·0735	9·0775	9·0816	4	8	12	16	20	24	28	32	37
75	9·0856	9·0896	9·0937	9·0977	9·1017	9·1057	9·1098	9·1138	9·1178	9·1218	4	8	12	16	20	24	28	32	36
76	9·1258	9·1298	9·1338	9·1378	9·1418	9·1458	9·1498	9·1537	9·1577	9·1617	4	8	12	16	20	24	28	32	36

	0	1	2	3	4	5	6	7	8	9	·1	·2	·3	·4	·5	·6	·7	·8	·9
77	9·1657	9·1696	9·1736	9·1775	9·1815	9·1855	9·1894	9·1933	9·1973	9·2012	4	8	12	16	20	24	28	32	36
78	9·2052	9·2091	9·2130	9·2170	9·2209	9·2248	9·2287	9·2326	9·2365	9·2404	4	8	12	16	20	24	27	31	35
79	9·2443	9·2482	9·2521	9·2560	9·2599	9·2638	9·2677	9·2716	9·2754	9·2793	4	8	12	16	19	23	27	31	35
80	9·2832	9·2870	9·2909	9·2948	9·2986	9·3025	9·3063	9·3102	9·3140	9·3179	4	8	12	15	19	23	27	31	35
81	9·3217	9·3255	9·3294	9·3332	9·3370	9·3408	9·3447	9·3485	9·3523	9·3561	4	8	11	15	19	23	27	30	34
82	9·3599	9·3637	9·3675	9·3713	9·3751	9·3789	9·3827	9·3865	9·3902	9·3940	4	8	11	15	19	23	27	30	34
83	9·3978	9·4016	9·4053	9·4091	9·4129	9·4166	9·4204	9·4241	9·4279	9·4316	4	8	11	15	19	23	26	30	34
84	9·4354	9·4391	9·4429	9·4466	9·4503	9·4541	9·4578	9·4615	9·4652	9·4690	4	7	11	15	19	22	26	30	34
85	9·4727	9·4764	9·4801	9·4838	9·4875	9·4912	9·4949	9·4986	9·5023	9·5060	4	7	11	15	18	22	26	30	33
86	9·5097	9·5134	9·5171	9·5207	9·5244	9·5281	9·5317	9·5354	9·5391	9·5427	4	7	11	15	18	22	26	29	33
87	9·5464	9·5501	9·5537	9·5574	9·5610	9·5647	9·5683	9·5719	9·5756	9·5792	4	7	11	14	18	22	25	29	33
88	9·5828	9·5865	9·5901	9·5937	9·5973	9·6010	9·6046	9·6082	9·6118	9·6154	4	7	11	14	18	21	25	29	33
89	9·6190	9·6226	9·6262	9·6298	9·6334	9·6370	9·6406	9·6442	9·6477	9·6513	4	7	11	14	18	21	25	29	32
90	9·6549	9·6585	9·6620	9·6656	9·6692	9·6727	9·6763	9·6799	9·6834	9·6870	4	7	11	14	18	21	25	28	32
91	9·6905	9·6941	9·6976	9·7012	9·7047	9·7082	9·7118	9·7153	9·7188	9·7224	4	7	11	14	18	21	25	28	32
92	9·7259	9·7294	9·7329	9·7364	9·7400	9·7435	9·7470	9·7505	9·7540	9·7575	3	7	10	14	17	21	25	28	32
93	9·7610	9·7645	9·7680	9·7715	9·7750	9·7785	9·7819	9·7854	9·7889	9·7924	3	7	10	14	17	20	24	28	31
94	9·7959	9·7993	9·8028	9·8063	9·8097	9·8132	9·8167	9·8201	9·8236	9·8270	3	7	10	14	17	20	24	28	31
95	9·8305	9·8339	9·8374	9·8408	9·8443	9·8477	9·8511	9·8546	9·8580	9·8614	3	7	10	14	17	21	24	27	31
96	9·8648	9·8683	9·8717	9·8751	9·8785	9·8819	9·8854	9·8888	9·8922	9·8956	3	7	10	14	17	20	24	27	31
97	9·8990	9·9024	9·9058	9·9092	9·9126	9·9160	9·9194	9·9227	9·9261	9·9295	3	7	10	14	17	20	24	27	31
98	9·9329	9·9363	9·9396	9·9430	9·9464	9·9497	9·9531	9·9565	9·9598	9·9632	3	7	10	13	17	20	24	27	30
99	9·9666	9·9699	9·9733	9·9766	9·9800	9·9833	9·9866	9·9900	9·9933	9·9967	3	7	10	13	17	20	23	27	30

THE METRIC SYSTEM

MEASURES OF LENGTH

10 millimetres	= 1 centimetre	10 decametres	= 1 hectometre
10 centimetres	= 1 decimetre	10 hectometres	= 1 kilometre
10 decimetres	= 1 metre	10 kilometres	= 1 myriametre
10 metres	= 1 decametre		

MEASURES OF CAPACITY

10 millilitres	= 1 centilitre	10 litres	= 1 decalitre
10 centilitres	= 1 decilitre	10 decalitres	= 1 hectolitre
10 decilitres	= 1 litre	10 hectolitres	= 1 kilolitre

1 litre = 1 cubic decimetre; 1 kilolitre = 1 cubic metre

MEASURES OF WEIGHT

10 milligrammes	= 1 centigramme
10 centigrammes	= 1 decigramme
10 decigrammes	= 1 gramme
10 grammes	= 1 decagramme
10 decagrammes	= 1 hectogramme
10 hectogrammes	= 1 kilogramme
10 kilogrammes	= 1 myriagramme
10 myriagrammes	= 1 quintal
10 quintals	= 1 millier or tonne

MEASURES OF SURFACE

100 square millimetres	= 1 square centimetre
100 square centimetres	= 1 square decimetre
100 square decimetres	= 1 square metre
100 square metres	= 1 square decametre = 1 are
100 square decametres	= 1 square hectometre
100 square hectometres	= 1 square kilometre

10 centiares	= 1 deciare	10 ares	= 1 decare
10 deciares	= 1 are	10 decares	= 1 hectare

CUBIC MEASURE

1000 cubic millimetres	= 1 cubic centimetre
1000 cubic centimetres	= 1 cubic decimetre
1000 cubic decimetres	= 1 cubic metre

CONVERSION TABLES

In the following conversion factors the pound (or gram) is a unit of mass. Where the pound (or gram) is meant as a unit of force the term 'pound weight' (or 'gram weight') is used.

All factors involving the change from the absolute to the gravitational system of units are based on the international standard acceleration due to gravity:

$$g_s = 32 \cdot 1740 \text{ ft./sec.}^2 = 980 \cdot 665 \text{ cm./sec.}^2$$

The dimensions of all quantities are given in terms of the fundamental quantities: mass (M), length (L), time (T).

LENGTH (L)

7·92 inches	= 1 link	5½ yards	= 1 rod, pole or perch
12 inches	= 1 foot	4 poles	= 1 chain
3 feet	= 1 yard	10 chains	= 1 furlong
6 feet	= 1 fathom	8 furlongs	= 1 mile

1 chain	= 22 yards	= 100 links	
1 mile	= 80 chains	= 1760 yards	= 5280 feet
1 nautical mile	= 1·151 miles	= 6080 feet	

1 inch	= 25·40 millimetres	1 millimetre	= 0·03937 inch
1 foot	= 30·48 centimetres	1 centimetre	= 0·03281 foot
1 yard	= 0·9144 metre	1 metre	= 39·37 inches
1 chain	= 20·12 metres	1 metre	= 1·094 yards
1 mile	= 1·609 kilometres	1 kilometre	= 0·6214 mile

1 nautical mile = 1·853 kilometres
1 fathom = 1·8288 metres

VOLUME (L³)

4 gills	= 1 pint	4 quarts	= 1 Imp. gallon
2 pints	= 1 quart	6·299 Imp. gallons	= 1 cu. foot

1 cu. foot		= 1,728 cu. inches	= 0·7787 bushel
1 cu. yard		= 46,656 cu. inches	= 21·03 bushels
1 shipping ton		= 40 cu. feet of merchandise	
1 shipping ton		= 42 cu. feet of timber	
1 standard of timber		= 165 cu. feet	

1 Imperial gallon	= 277·4 cu. inches	= 0·1605 cu. foot
1 U.S. gallon	= 231·0 cu. inches	= 0·1337 cu. foot
1 litre	= 61·02 cu. inches	= 0·03532 cu. foot

1 cu. inch	= 16·39 cu. cms.
1 cu. foot	= 0·02832 cu. metre
1 cu. yard	= 0·7646 cu. metre
1 pint	= 0·5683 litre
1 Imperial gallon	= 4·546 litres
1 cu. foot	= 28·32 litres
1 Imperial gallon	= 1·201 U.S. gallons
1 cu. cm.	= 0·06102 cu. inch
1 cu. metre	= 35·32 cu. feet
1 cu. metre	= 1·308 cu. yards
1 litre	= 1·000 cu. cm.
1 litre	= 0·2200 Imperial gallon
1 litre	= 0·03532 cu. foot
1 U.S. gallon	= 0·8327 Imperial gallon

AREA (L²)

144 sq. inches	= 1 sq. foot	4840 sq. yards	= 1 acre
9 sq. feet	= 1 sq. yard	640 acres	= 1 sq. mile

1 acre = 10 sq. chains = 160 sq. rods = 43,560 sq. feet = 100,000 sq. links

1 square of flooring or roofing = 100 sq. feet

1 sq. inch	= 6·452 sq. centimetres
1 sq. foot	= 929·0 sq. centimetres
1 sq. yard	= 0·8361 sq. metre
1 acre	= 40·47 ares
1 sq. mile	= 259·0 hectares
1 sq. centimetre	= 0·1550 sq. inch
1 sq. metre	= 10·76 sq. feet
1 sq. metre	= 1·196 sq. yards
1 hectare	= 2·471 acres
1 hectare	= 0·003861 sq. mile

1 hectare = 100 ares = 10,000 sq. metres

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MASS (M)

(*All English units are Avoirdupois*)

27·34 grains	= 1 dram	28 pounds	= 1 quarter
16 drams	= 1 ounce	4 quarters	= 1 cwt.
16 ounces	= 1 pound	20 cwt.	= 1 ton
7000 grains	= 1 pound	112 pounds	= 1 cwt.
14 pounds	= 1 stone	2240 pounds	= 1 ton

1 grain	= 0·0648 gram	1 milligram	= 0·01543 grain
1 dram	= 1·772 grams	1 gram	= 15·43 grains
1 ounce	= 28·35 grams	1 gram	= 0·03527 ounce
1 pound	= 0·4536 kilograms	1 kilogram	= 2·205 pounds
1 cwt.	= 50·80 kilograms	1 kilogram	= 0·01968 cwt.
1 ton	= 1·016 tonnes	1 tonne	= 0·9842 ton

1 tonne (metric ton)	= 10 quintals	= 1000 kilograms
1 U.S. long ton	= 2240 pounds	= 1 English ton
1 U.S. short ton	= 2000 pounds	= 0·8929 English ton
1 U.S. kip	= 1000 pounds	= 0·4465 English ton
1 U.S. cwt.	= 100 pounds	= 0·8929 English cwt.

LINEAR VELOCITY ($\frac{L}{T}$)

1 m.p.h.	= 88 feet/min.	1 foot/min.	= 0·01136 m.p.h.
1 m.p.h.	= 1·467 feet/sec.	1 foot/sec.	= 0·6817 m.p.h.
1 m.p.h.	= 0·4470 metre/sec.	1 metre/sec.	= 2·237 m.p.h.
1 foot/min.	= 0·5080 cm./sec.	1 cm./sec.	= 1·967 feet/min.

DENSITY ($\frac{M}{L^3}$)

1 lb./cu. in.	= 27·68 g./cu. cm.
1 lb./cu. ft.	= 16·02 kg./cu. m.
1 lb./cu. yd.	= 0·5930 kg./cu. m.
1 ton/cu. yd.	= 1·328 tonnes/cu. m
1 grain/gal.	= 0·01425 g./litre
1 part/100,000	= 0·7017 grain/gal.
1 part/million (p.p.m.)	= 0·07017 grain/gal.
1 g./cu. cm.	= 0·03613 lb./cu. in.
1 kg./cu. m.	= 0·06243 lb./cu. ft.
1 kg./cu. m.	= 1·686 lb./cu. yd.
1 tonne/cu. m.	= 0·7532 ton/cu. yd.
1 g./litre	= 70·17 grains/gal.
1 grain/gal.	= 1·425 parts/100,000
1 grain/gal.	= 14·25 parts/million

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CONVERSION TABLES (*continued*)

POWER CONVERSION FACTORS $\left(\dfrac{ML^2}{T^3}\right)$

(In this table, pound means pound weight and kilogram means kilogram weight)

	Horse power	Metric horse power	Kilowatt	Foot-pound/second	Kg-metre/second	B.Th.U./hour	Kilo-calorie/hour
Horse power	1	1·014	0·7457	550	76·04	2545	641·3
Metric horse power	0·9863	1	0·7355	542·5	75	2510	632·6
Killowatt	1·341	1·36	1	737·6	102	3413	860
Foot-pound/second	0·001818	0·001843	0·001356	1	0·1383	4·627	1·166
Kg-metre/second	0·01315	0·01333	0·009807	7·233	1	33·47	8·433
B.Th.U./hour	0·0003929	0·0003984	0·000293	0·2161	0·02988	1	0·252
Kilo-calorie/hour	0·001559	0·001581	0·001163	0·8576	0·1186	3·968	1

Evaporation of 1 lb. of steam per hour from and at 212° F.
= 970·6 B.Th.U./hour = 0·3815 H.P.

The Metric Horse Power is also known as the Cheval Vapeur, Force de Cheval, or Pferdekraft.

CONVERSION TABLES (*continued*)

HEAT AND WORK CONVERSION FACTORS $\left(\dfrac{ML^2}{T^2}\right)$

(In this table, pound means pound weight and kilogram means kilogram weight)

	B.Th.U.	C.H.U.	Kilogram-calorie	Foot-pound	Kilogram-metre	Joule	kWh
B.Th.U.	1	0·5555	0·252	778	107·6	1055	0·000293
C.H.U.	1·8	1	0·4536	1400	193·6	1899	0·0005274
Kilogram-calorie	3·968	2·205	1	3087	426·8	4186	0·001163
Foot-pound	0·001285	0·0007141	0·0003239	1	0·1383	1·356	$3·767 \times 10^{-7}$
Kilogram-metre	0·009297	0·005165	0·002343	7·233	1	9·81	$2·724 \times 10^{-6}$
Joule	0·000948	0·0005266	0·0002389	0·7375	0·1019	1	$2·778 \times 10^{-7}$
kWh	3413	1896	860	2,656,000	367,100	3,600,000	1

1 Therm = 100,000 B.Th.U.   1 Joule = 1 Watt-second = 10^7 Ergs.   1 Erg = 1 Dyne-centimetre.

CONVERSION TABLES (continued)

PRESSURE CONVERSION FACTORS $\left(\frac{M}{LT^2}\right)$

(In this table, pound means pound weight and kilogram means kilogram weight)

	Lb./sq. in.	Lb./sq. ft.	Standard atmosphere	Ft. head of water at 62° F.	In. head of water at 62° F.	In. head of mercury at 32° F.	Kg./sq. cm.
Lb./sq. in.	1	144	0·06805	2·312	27·74	2·036	0·07031
Lb./sq. ft.	0·006944	1	0·0004726	0·01605	0·1926	0·01414	0·0004882
Standard atmosphere	14·696	2116	1	33·95	407·4	29·92	1·033
Ft. head of water at 62° F.	0·4325	62·29	0·02944	1	12	0·8806	0·03042
In. head of water at 62° F.	0·03604	5·191	0·002451	0·0833	1	0·07338	0·002535
In. head of mercury at 32° F.	0·4912	70·73	0·03342	1·135	13·62	1	0·03453
Kg./sq. cm.	14·22	2048	0·9678	32·87	394·4	28·96	1

1 Standard Atmosphere = Pressure of 76 cm. column of mercury, density 13·5951 g./c.c., acceleration due to gravity 980·665 cm./sec.²
= 14·6959 lb./sq. in.

1 Bar = 1000 millibars = 10⁶ dynes/sq. cm. = 14·5 lb./sq. in. = 0·9869 standard atmosphere.

CONVERSION TABLES (continued)

DECIMAL EQUIVALENTS OF FRACTIONS

Fraction	Decimal	Fraction	Decimal	Fraction	Decimal
1/64	·01563	11/32	·34375	43/64	·67188
1/32	·03125	23/64	·35938	11/16	·6875
3/64	·04688	3/8	·375	45/64	·70313
1/16	·0625	25/64	·39063	23/32	·71875
5/64	·07813	13/32	·40625	47/64	·73438
3/32	·09375	27/64	·42188	3/4	·75
7/64	·10938	7/16	·4375	49/64	·76563
1/8	·125	29/64	·45313	25/32	·78125
9/64	·14063	15/32	·46875	51/64	·79688
5/32	·15625	31/64	·48438	13/16	·8125
11/64	·17188	1/2	·5	53/64	·82813
3/16	·1875	33/64	·51563	27/32	·84375
13/64	·20313	17/32	·53125	55/64	·85938
7/32	·21875	35/64	·54688	7/8	·875
15/64	·23438	9/16	·5625	57/64	·89063
1/4	·25	37/64	·57813	29/32	·90625
17/64	·26563	19/32	·59375	59/64	·92188
9/32	·28125	39/64	·60938	15/16	·9375
19/64	·29688	5/8	·625	61/64	·95313
5/16	·3125	41/64	·64063	31/32	·96875
21/64	·32813	21/32	·65625	63/64	·98438

Inch	0	1	2	3	4	5
0	0·0	0·0833	0·1667	0·2500	0·3333	0·4167
$\frac{1}{32}$	·0026	·0859	·1693	·2526	·3359	·4193
$\frac{1}{16}$	·0052	·0885	·1719	·2552	·3385	·4219
$\frac{3}{32}$	·0078	·0911	·1745	·2578	·3411	·4245
$\frac{1}{8}$	·0104	·0938	·1771	·2604	·3438	·4271
$\frac{5}{32}$	·0130	·0964	·1797	·2630	·3464	·4297
$\frac{3}{16}$	·0156	·0990	·1823	·2656	·3490	·4323
$\frac{7}{32}$	·0182	·1016	·1849	·2682	·3516	·4349
$\frac{1}{4}$	·0208	·1042	·1875	·2708	·3542	·4375
$\frac{9}{32}$	·0234	·1068	·1901	·2734	·3568	·4401
$\frac{5}{16}$	·0260	·1094	·1927	·2760	·3594	·4427
$\frac{11}{32}$	·0286	·1120	·1953	·2786	·3620	·4453
$\frac{3}{8}$	·0313	·1146	·1979	·2813	·3646	·4479
$\frac{13}{32}$	·0339	·1172	·2005	·2839	·3672	·4505
$\frac{7}{16}$	·0365	·1198	·2031	·2865	·3698	·4531
$\frac{15}{32}$	·0391	·1224	·2057	·2891	·3724	·4557
$\frac{1}{2}$	·0417	·1250	·2083	·2917	·3750	·4583
$\frac{17}{32}$	·0443	·1276	·2109	·2943	·3776	·4609
$\frac{9}{16}$	·0469	·1302	·2135	·2969	·3802	·4635
$\frac{19}{32}$	·0495	·1328	·2161	·2995	·3828	·4661
$\frac{5}{8}$	·0521	·1354	·2188	·3021	·3854	·4688
$\frac{21}{32}$	·0547	·1380	·2214	·3047	·3880	·4714
$\frac{11}{16}$	·0573	·1406	·2240	·3073	·3906	·4740
$\frac{23}{32}$	·0599	·1432	·2266	·3099	·3932	·4766
$\frac{3}{4}$	·0625	·1458	·2292	·3125	·3958	·4792
$\frac{25}{32}$	·0651	·1484	·2318	·3151	·3984	·4818
$\frac{13}{16}$	·0677	·1510	·2344	·3177	·4010	·4844
$\frac{27}{32}$	·0703	·1536	·2370	·3203	·4036	·4870
$\frac{7}{8}$	·0729	·1563	·2396	·3229	·4063	·4896
$\frac{29}{32}$	·0755	·1589	·2422	·3255	·4089	·4922
$\frac{15}{16}$	·0781	·1615	·2448	·3281	·4115	·4948
$\frac{31}{32}$	·0807	·1641	·2474	·3307	·4141	·4974
1	—	—	—	—	—	—

Inch	6	7	8	9	10	11
0	0·5000	0·5833	0·6667	0·7500	0·8333	0·9167
$\frac{1}{32}$	·5026	·5859	·6693	·7526	·8359	·9193
$\frac{1}{16}$	·5052	·5885	·6719	·7552	·8385	·9219
$\frac{3}{32}$	·5078	·5911	·6745	·7578	·8411	·9245
$\frac{1}{8}$	·5104	·5938	·6771	·7604	·8438	·9271
$\frac{5}{32}$	·5130	·5964	·6797	·7630	·8464	·9297
$\frac{3}{16}$	·5156	·5990	·6823	·7656	·8490	·9323
$\frac{7}{32}$	·5182	·6016	·6849	·7682	·8516	·9349
$\frac{1}{4}$	·5208	·6042	·6875	·7708	·8542	·9375
$\frac{9}{32}$	·5234	·6068	·6901	·7734	·8568	·9401
$\frac{5}{16}$	·5260	·6094	·6927	·7760	·8594	·9427
$\frac{11}{32}$	·5286	·6120	·6953	·7786	·8620	·9453
$\frac{3}{8}$	·5313	·6146	·6979	·7813	·8646	·9479
$\frac{13}{32}$	·5339	·6172	·7005	·7839	·8672	·9505
$\frac{7}{16}$	·5365	·6198	·7031	·7865	·8698	·9531
$\frac{15}{32}$	·5391	·6224	·7057	·7891	·8724	·9557
$\frac{1}{2}$	·5417	·6250	·7083	·7917	·8750	·9583
$\frac{17}{32}$	·5443	·6276	·7109	·7943	·8776	·9609
$\frac{9}{16}$	·5469	·6302	·7135	·7969	·8802	·9635
$\frac{19}{32}$	·5495	·6328	·7161	·7995	·8828	·9661
$\frac{5}{8}$	·5521	·6354	·7188	·8021	·8854	·9688
$\frac{21}{32}$	·5547	·6380	·7214	·8047	·8880	·9714
$\frac{11}{16}$	·5573	·6406	·7240	·8073	·8906	·9740
$\frac{23}{32}$	·5599	·6432	·7266	·8099	·8932	·9766
$\frac{3}{4}$	·5625	·6458	·7292	·8125	·8958	·9792
$\frac{25}{32}$	·5651	·6484	·7318	·8151	·8984	·9818
$\frac{13}{16}$	·5677	·6510	·7344	·8177	·9010	·9844
$\frac{27}{32}$	·5703	·6536	·7370	·8203	·9036	·9870
$\frac{7}{8}$	·5729	·6563	·7396	·8229	·9063	·9896
$\frac{29}{32}$	·5755	·6589	·7422	·8255	·9089	·9922
$\frac{15}{16}$	·5781	·6615	·7448	·8281	·9115	·9948
$\frac{31}{32}$	·5807	·6641	·7474	·8307	·9141	·9974
1	—	—	—	—	—	1·0000

C	F	C	F	C	F
380		480		580	
	710		890		1070
370	700	470	880	570	1060
	690		870		1050
360	680	460	860	560	1040
	670		850		1030
350	660	450	840	550	1020
	650		830		1010
340	640	440	820	540	1000
	630		810		990
330	620	430	800	530	980
	610		790		970
320	600	420	780	520	960
310	590	410	770	510	950
	580		760		940
300	570	400	750	500	930
	560		740		920
290	550	390	730	490	910
	540		720		900
280		380		480	

C	F	C	F	C	F
80		180		280	
	170		350		530
70	160	170	340	270	520
	150		330		510
60	140	160	320	260	500
	130		310		490
50	120	150	300	250	480
	110		290		470
40	100	140	280	240	460
	90		270		450
30	80	130	260	230	440
	70		250		430
20	60	120	240	220	420
10	50	110	230	210	410
	40		220		400
0	30	100	210	200	390
	20		200		380
-10	10	90	190	190	370
	0		180		360
-20	-4	80		180	

PRESSURE CONVERSION TABLE

Kg. per sq. cm.	0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
				Pounds per Square Inch						
0	0·00	1·42	2·85	4·27	5·69	7·12	8·53	9·96	11·38	12·80
1	14·22	15·65	17·07	18·49	19·91	21·34	22·76	24·18	25·60	27·02
2	28·45	29·87	31·29	32·71	34·14	35·56	36·98	38·40	39·83	41·25
3	42·67	44·09	45·52	46·94	48·36	49·78	51·20	52·63	54·05	55·47
4	56·89	58·32	59·74	61·16	62·58	64·01	65·43	66·85	68·27	69·69
5	71·12	72·54	73·96	75·38	76·81	78·29	79·65	81·07	82·30	83·92
6	85·34	86·76	88·19	89·61	91·03	92·45	93·87	95·30	96·72	98·14
7	99·56	100·99	102·41	103·83	105·25	106·67	108·10	109·52	110·94	112·36
8	113·79	115·21	116·63	118·05	119·48	120·90	122·32	123·74	125·17	126·59
9	128·01	129·43	130·85	132·28	133·70	135·12	136·54	137·97	139·39	140·81
10	142·23	143·66	145·08	146·50	147·92	149·34	150·77	152·19	153·61	155·03

VISCOSITY CONVERSION TABLE

Seconds Redwood No. 1	Seconds Saybolt Universal	Degrees Engler	Kinematic Viscosity Stokes
30	33	1·06	0·015
40	45	1·45	0·058
60	68	2·08	0·126
80	91	2·73	0·185
100	114	3·37	0·237
150	170	4·91	0·365
200	226	6·51	0·487
220	248	7·15	0·532
250	283	8·15	0·617
300	340	9·78	0·741
350	397	11·4	0·865
400	452	13·0	0·988
450	508	14·7	1·11
500	564	16·3	1·23
600	676	19·5	1·48
700	790	22·8	1·73
800	902	26·1	1·97
900	1015	29·3	2·22
950	1068	30·9	2·34
1000	1130	32·6	2·47
1100	1242	35·9	2·71
1200	1354	39·1	2·96
1300	1467	42·4	3·21
1400	1576	45·7	3·46
1500	1690	48·9	3·70
1600	1804	51·2	3·95
1700	1914	55·4	4·20
1800	2028	58·7	4·45
1900	2144	62·0	4·70
2000	2255	65·2	4·94
2200	2478	71·8	5·43
2400	2696	78·2	5·93
2600	2924	84·8	6·42
2800	3142	91·3	6·92
3000	3370	97·8	7·41
3250	3650	105·9	8·03
3500	3935	114·1	8·65
3750	4220	122·2	9·26
4000	4500	130·2	9·88
4500	5060	146·6	11·11
5000	5620	163·0	12·34

Pipe Bore Inches	Velocity in Feet per Second				
	2	4	6	8	10
	Gallons per Hour				
¼	15	30	46	61	76
⅜	34	69	103	137	172
½	61	122	184	245	306
⅝	94	190	285	380	474
¾	138	276	414	552	690
1	245	490	735	980	1225
1¼	382	765	1150	1530	1910
1½	550	1100	1650	2200	2750
2	980	1960	2940	3920	4900
2½	1530	3060	4590	6120	7650
3	2200	4410	6620	8820	11000
4	3920	7840	11750	15700	19600
5	6120	12250	18350	24500	30600
6	8800	17600	26400	35200	44000
7	12000	24000	36000	48000	60000

Material	Pounds per cubic foot	Cubic feet per ton	Cubic inches per pound
Fresh water	62	36	28
Sea water	64	35	27
Resin	66	34	26
Ground dry fireclay ⎱ Saltcake	70	32	24·6
Bones ⎱ Nitrate of ammonia ⎱ Nitrate of soda	72	31	24
Chalk lumps ⎱ Loose earth	78	29	22
Calcined limestone ⎱ Crushed chalk ⎱ Earth ⎱ Loose clay and marl ⎱ Crushed slag ⎱ Ground gypsum	80	28	21·6
Phosphate rock	81	27·5	21
Blast furnace slag ⎱ Crushed silica ⎱ Portland cement	86	26	20
Shingle	88	25·5	19·5
Broken limestone ⎱ Coprolites	90	25	19·3
Clay shale, loose	93	24	18·5
Dried mud ⎱ Stone dust ⎱ Granite chippings	95	23·6	18·2
Fine sand	96	23·2	17·9
Coarse gravel ⎱ Plaster	98	23	17·7
Cement clinker ⎱ Coarse pit sand ⎱ Common bricks ⎱ Crushed basalt ⎱ Pit dirt ⎱ Phosphate pebble ⎱ Slate dust	100	22·4	17·2
Hard bath stone, broken	102	22	17
Plaster of Paris ⎱ Lead ore	106	21	16·2
Gravel, average	109	20·5	16
Bauxite ⎱ Phosphate meal	110	20·4	15·7

Material	Pounds per cubic foot	Cubic feet per ton	Cubic inches per pound
Ballast, loose Powdered sulphur Tin ore	112	20	15·4
Asphalt, loose Ground cement Concrete Gypsum, broken	120	18·7	14·5
Bath stone Solid chalk Solid rock sulphur	125	18	14
Barytes Red sandstone Powdered phosphate	130	17	13
Derby stone, broken Salt rock	136	16·5	12·7
Plumbago Portland stone, broken Sandstone, broken Quartz, broken	140	16	12·5
Granite, broken Spanish iron ore	150	15	11·5
Iron pyrites	156	14·3	10·6
Shale Zinc spelter	162	13·8	10·5
Crushed dolomite	165	13·5	10·4
Quartz sand	170	13	10·2
Lead oxide	184	12·2	9·4
Copper pyrites, fine	187	12	9·6
Iron ore, Clydesdale	190	11·8	9·5
Tin ore	200	11·2	8·2
Brown iron ore	245	9·2	7·1
Red iron ore	320	7	5·4
Dry hops	6·5	350	270
Cork dust	7	320	246
Dry sawdust	8	280	216
Wood meal	8·5	270	208
Bran Dry Peat	11	204	157
Beet, dried pulp	14	160	125
Flaked soap	16	140	108
Ground oak bark	17	132	102
Logwood dust Flue dust	18	124	95

Material	Pounds per cubic foot	Cubic feet per ton	Cubic inches per pound
Dry paper pulp Green malt	20	112	86
Cotton seed	22	100	77
Breadcrumbs Charcoal Locust beans Calcined bones	23	97	75
Degreased crushed bones	25	90	69
Seedlac Spent tan	27	83	64
Shredded soap Wood chips	28	80	61·5
Damp wood pulp Dry apple pulp or pumice Gas coke Malt Oats	30	75	58
Hempseed	31	72	55
Crushed bones Hydrated lime Soda ash	35	64	49
Cotton seed Rape seed Spent hops	36	62	47
Buckwheat	37	61	46
Sugar beet	38	59	45
Coke breeze Barley Hot wet grains Oatmeal	39	58	44·5
Furnace coke Gasworks lime Steamed bones	40	56	43
Indian corn meal Linseed Rye	41	55	42
Bean and pea meal Flour Coal nuts	43	52	40
Coal ashes	44	51	39

Material	Pounds per cubic foot	Cubic feet per ton	Cubic inches per pound
Anthracene Powdered coal Indian corn or maize Coarse salt Soda ash	45	50	38·5
Sodium bicarbonate	46	49	37·7
Potatoes Wheat	47	48	37
Horse beans	49	46	35·5
Peas and beans Fine white sugar Broken ice Sulphate of ammonia Wet char	50	45	34·6
Welsh steam coal Anthracite coal, loose Quicklime Rye	53	42	32·5
Bone meal Block ice Boiler ashes Asbestos grit	56	40	31
Broken glass or cullet Crushed dolomite (calcined) Pitch Oxide of iron Wet bone char Superphosphate of lime	60	37	28·5

Relative Humidity

Relative humidity is defined as the ratio, expressed as a percentage, between the water vapour in air at a given temperature and the maximum water vapour the air can hold (i.e. saturated air) at the same temperature.

How to use the tables:

Take the reading of the wet-bulb and dry-bulb temperatures at as nearly the same moment as possible.

Subtract the wet-bulb reading from the dry-bulb reading.

The per cent relative humidity is the number at the intersection of the temperature difference column (vertical) with the dry-bulb temperature column (horizontal).

Difference Between Wet- and Dry-Bulb Readings, Degrees Centigrade: 760 mm Hg

Dry-Bulb Temp. °C	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	82	64	47	31	14															
1	83	66	50	34	18															
2	83	67	52	37	22	8														
3	84	68	54	40	25	12														
4	84	69	55	42	29	16	3													
5	85	70	56	44	32	19	7													
6	86	72	58	46	34	23	11													
7	86	73	60	48	37	26	14	3												
8	87	74	61	49	39	28	17	6												
9	88	75	63	51	41	31	20	10												
10	88	77	65	55	44	34	24	14	5											
11	89	77	66	56	46	36	26	17	8											
12	89	78	68	57	48	38	29	20	11	3										
13	89	78	69	59	49	40	31	23	14	6										
14	90	79	69	60	51	42	33	25	17	9										
15	90	80	71	61	53	44	35	27	20	12	5									
16	90	81	71	62	54	45	37	30	22	15	8	1								
17	91	81	72	63	55	47	39	32	24	17	10	4								
18	91	82	73	65	57	49	41	34	27	20	13	7								
19	91	82	74	65	58	50	43	36	29	22	16	9	3							
20	91	83	74	66	59	51	44	37	30	24	18	12	6							
21	91	83	75	67	60	52	45	39	32	26	20	14	9	3						
22	92	83	75	68	61	54	47	40	34	28	22	16	11	5						
23	92	84	76	69	62	55	48	42	36	30	24	18	13	8	3					
24	92	84	77	70	63	56	50	43	37	32	26	21	16	11	6					
25	92	85	77	70	63	57	51	45	39	34	28	23	18	13	9	4				
26	92	85	78	71	65	58	52	47	41	36	30	25	20	16	11	7	3			
27	93	85	78	72	65	59	53	48	42	37	32	27	22	18	14	10	6			
28	93	86	79	72	66	60	54	49	43	38	34	28	24	20	16	12	9	5		
29	93	86	79	73	67	61	55	49	44	39	35	29	25	21	19	15	11	8	3	
30	93	86	79	73	67	61	55	50	44	40	34	30	26	21	18	14	10	7	3	
31	93	87	80	73	67	61	56	51	45	41	36	31	27	24	20	16	13	9	5	
32	93	87	80	74	68	62	57	52	46	42	37	32	28	25	21	18	14	11	7	3
33	93	87	81	74	69	63	58	52	48	43	39	34	30	26	23	19	16	13	8	5
34	93	87	81	75	69	64	58	53	48	44	39	35	31	28	24	21	17	15	12	8

Dry-Bulb Temp. °C	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
35	93	87	81	75	70	64	59	54	49	44	40	36	32	29	25	21	18	15	11	8	4	2																							
36	93	87	81	76	70	65	59	55	50	45	41	37	33	30	26	23	19	16	13	10	6	3																							
37	94	88	82	76	71	65	60	55	50	46	42	38	34	31	27	24	21	17	14	11	8	5																							
38	94	88	82	76	71	66	61	56	51	47	43	39	35	32	28	25	22	18	16	13	10	7	3																						
39	94	88	82	77	71	66	61	57	52	48	44	40	36	33	29	26	23	20	17	14	11	8	5																						
40	94	88	83	77	72	67	62	58	53	49	44	41	37	34	30	27	24	21	19	16	13	10	7	4												3				3					
42	94	88	83	78	72	67	63	58	54	50	45	42	38	35	31	28	25	22	20	17	14	11	9	6	3											4				4					
44	94	88	83	78	73	68	63	59	55	51	46	43	39	36	32	30	26	24	21	18	16	13	11	8	5											5				5					
46	94	88	83	78	73	68	64	59	55	51	47	44	40	37	33	31	27	25	22	19	17	14	12	10	7	4										6				6					
48	94	89	83	78	74	69	65	60	56	52	48	45	41	38	34	32	29	26	24	21	19	16	14	12	9	6	2									7				7					
50	94	89	84	79	74	70	65	61	57	53	50	46	42	39	36	33	30	28	25	23	20	18	16	14	12	8	6	3							3	8	5			8					
52	95	89	84	79	75	70	66	62	57	54	51	47	43	40	37	34	31	29	27	24	22	20	17	15	12	10	8	5	3						4	9	6			9					
54	95	90	84	80	75	71	66	62	58	55	52	48	45	42	39	36	33	30	28	26	24	21	19	17	15	13	10	8	5	3					5	10	7			10					
56	95	90	85	80	76	71	67	63	59	55	53	49	46	42	40	37	35	32	29	27	25	23	21	19	17	14	12	10	7	5	3				6	11	8			11					
58	95	91	85	81	76	72	68	64	60	56	54	50	48	45	42	39	36	34	32	29	26	24	22	20	18	16	14	12	10	8	6	4	2		7	12	9			12					
60	95	91	86	81	77	72	69	64	60	58	55	51	48	46	43	40	38	35	33	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	8	13	10	8	6	13					
62	95	91	86	81	77	73	69	65	61	58	56	52	49	47	44	41	39	36	34	32	29	27	25	23	21	19	17	15	13	11	9	7	5	4	9	14	11	9	7	14					
64	96	91	86	82	77	73	70	66	62	59	57	53	50	48	45	42	40	37	35	33	31	28	26	24	22	20	18	16	14	12	10	9	7	5	10	15	12	10	8	15					
66	96	92	87	82	78	74	70	66	62	60	58	54	51	48	46	43	41	39	36	34	32	30	28	26	24	22	20	18	16	14	12	11	9	7	11	16	13	11	9	16					
68	96	92	87	83	78	74	70	67	64	61	57	55	52	49	47	44	42	40	37	35	33	31	29	27	25	23	21	19	17	16	14	12	11	9	12	17	14	12	10	17					
70	96	92	88	83	79	76	72	69	65	62	55	56	53	49	46	44	42	40	38	35	33	31	29	27	26	24	22	20	19	17	15	14	12	11	14	18	15	14	11	18	14				
72	96	92	88	84	79	76	72	69	66	62	58	57	54	50	47	45	43	41	39	36	35	32	30	28	27	25	23	22	20	19	16	15	13	11	15	19	16	15	12	19	15				
74	96	92	88	84	80	76	73	70	66	63	59	58	55	51	48	46	44	42	40	37	36	33	31	30	28	26	25	23	21	20	18	16	15	13	16	20	17	16	13	20	16				
76	96	93	88	85	80	77	73	70	67	64	60	59	56	53	50	48	45	43	41	39	37	35	33	31	29	28	26	24	23	21	19	18	16	15	17	21	18	17	15	21	17				
78	96	93	89	85	80	77	74	71	68	64	61	60	57	54	51	48	46	44	42	40	38	36	34	32	30	29	27	25	24	22	20	19	18	16	18	22	19	18	16	22	18				
80	96	92	88	83	79	76	72	69	65	62	62	59	56	54	51	49	47	45	43	41	39	37	35	33	32	30	28	27	25	24	23	22	20	19	19	24	21	19	16	24	19				
82	96	93	88	84	81	76	73	70	67	63	63	60	57	55	52	50	48	46	44	42	40	38	36	35	33	31	29	28	26	25	24	23	21	20	20	25	22	20	17	25	20				
84	96	93	89	85	82	77	74	71	68	64	63	60	58	56	53	51	48	46	45	43	41	39	37	36	34	32	30	28	27	26	25	24	22	21	21	26	23	21	18	26	21				
86	96	93	89	85	83	77	75	72	68	64	63	62	58	56	54	51	49	47	45	43	42	40	38	36	35	33	31	29	28	27	26	25	23	22	22	27	24	22	19	27	22				
88	96	93	89	86	82	77	76	72	72	64	64	61	59	57	54	52	50	48	46	44	43	41	38	37	36	34	32	31	29	28	27	26	24	23	23	28	25	23	20	28	23				
90	96	93	89	86	82	78	76	73	70	64	64	62	60	58	55	52	50	49	47	45	43	42	40	38	37	35	34	32	30	29	28	27	25	24	24	30	26	24	21	28	24				
92	96	93	89	86	83	79	76	73	70	65	65	63	60	58	56	53	51	49	47	46	44	42	40	39	37	36	34	33	31	30	29	28	26	25	25	30	27	25	22	29	25				
94	96	93	89	86	83	79	76	73	71	66	66	63	60	58	56	53	51	49	48	47	45	43	41	40	38	36	35	33	32	31	30	29	27	26	26	31	28	26	23	30	26				
96	96	93	89	86	83	80	77	74	72	68	66	63	60	58	56	54	52	50	48	46	44	42	40	38	36	35	33	32	30	29	27	26	24	23	23	32	29	27	24	31	27				
98 / 100	96	93	89	86	83	80	77	74	72	69	66	63	60	58	55	52	50	48	46	44	42	40	38	36	35	33	31	30	28	27	25	24	23	22	23	32	32	30	28	33	28				

Per cent Relative Humidity for Fahrenheit Temperature Differences Up to 45°

Difference between Wet- and Dry-Bulb Readings, Degrees Fahrenheit; Pressure 30″

Dry-Bulb Reading °F.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
35	91	81	72	63	54	45	36	27	19	10											
36	91	82	73	64	55	46	38	29	21	13											
37	91	83	74	65	57	48	40	31	23	15											
38	91	83	75	66	58	50	42	33	25	17	10										
39	92	83	75	67	59	51	43	35	27	20	12	5									
40	92	83	75	68	60	52	45	37	29	22	15	7	0								
41	92	84	76	69	61	54	46	39	31	24	17	10									
42	92	85	77	69	62	55	47	40	33	26	19	12	5								
43	92	85	77	70	63	55	48	42	35	28	21	14	8	1							
44	93	86	78	71	64	57	51	44	38	31	24	18	12	6							
45	93	86	78	72	65	58	52	45	39	32	26	20	14	8	2						
46	93	86	79	72	66	59	53	46	40	34	28	22	16	10	5	0					
47	93	86	79	73	66	60	54	47	41	35	29	23	18	12	7	1					
48	93	87	80	73	67	61	55	49	42	36	31	25	19	14	9	3					
49	93	86	80	73	67	61	54	48	42	36	31	25	20	14	9	5	0				
50	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5	0				
51	94	87	81	75	68	62	56	50	44	39	34	28	23	17	13	7	4				
52	94	87	81	75	69	63	57	51	46	40	35	29	24	19	14	9	5	1			
53	94	87	81	75	69	63	58	51	47	41	36	31	26	20	16	11	6	3			
54	94	88	82	76	70	64	59	53	48	42	37	32	27	22	17	13	8	5			
55	94	88	82	76	70	65	59	54	49	43	38	33	28	23	19	14	10	6	1		
56	94	88	82	76	71	65	60	55	49	44	39	34	30	25	20	16	11	8	3		
57	94	88	83	77	71	66	61	55	50	45	40	35	31	26	22	18	13	9	5	1	
58	94	88	83	77	72	66	61	56	51	46	41	37	32	27	23	19	14	10	6	3	
59	94	89	83	78	72	67	62	57	52	47	42	38	33	29	24	20	16	12	7	4	1
60	94	89	83	78	73	68	63	58	53	48	43	39	34	30	26	21	17	13	9	5	1
61	94	89	84	78	73	68	63	58	54	49	44	40	35	31	27	23	18	14	10	7	4
62	94	89	84	79	74	69	64	59	54	50	45	41	36	32	28	24	20	16	12	8	4

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Dry-Bulb Reading °F.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
63	95	89	84	79	74	69	64	60	55	50	46	42	37	33	29	25	21	17	13	10	6	2															
64	95	90	84	79	74	70	65	60	56	51	47	43	38	34	30	26	22	18	15	11	7	4	1														
65	95	90	85	80	75	70	65	61	57	52	48	44	40	35	31	27	24	20	16	13	9	6	3														
66	95	90	85	80	75	70	66	61	57	53	49	45	41	36	32	29	25	21	17	14	10	7	4	1													
67	95	90	85	80	76	71	67	62	58	54	50	46	42	38	34	30	27	23	19	16	12	9	6	3													
68	95	90	85	80	76	71	67	63	59	55	51	47	43	39	35	32	28	24	21	18	14	11	8	5	1												
69	95	90	85	81	76	72	67	63	59	55	51	47	44	40	36	33	29	26	22	19	15	12	9	6	3												
70	95	90	86	81	77	72	68	64	60	56	52	49	45	41	38	34	30	27	24	20	17	14	11	8	5	1											
71	95	90	86	81	77	72	68	64	60	57	53	49	46	42	39	35	31	28	25	22	18	15	12	9	6	3											
72	95	91	86	82	77	73	69	65	61	57	54	50	47	43	40	36	33	29	26	23	20	17	14	11	8	6	3										
73	95	91	86	82	78	73	69	65	62	58	54	51	47	44	41	37	34	30	27	24	21	18	15	12	10	7	4	1									
74	96	91	87	82	78	74	70	66	62	59	55	52	48	45	42	38	35	31	28	25	22	19	16	14	11	8	6	3									
75	96	91	87	83	78	74	70	66	63	59	56	52	49	46	43	39	36	33	30	27	24	21	18	15	12	10	7	5	2								
76	96	91	87	83	79	75	71	67	63	60	56	53	50	47	43	40	37	34	30	27	25	22	19	16	13	11	8	6	3	1							
77	96	91	87	83	79	75	71	67	64	60	57	54	50	47	44	41	38	34	31	29	26	23	20	17	15	12	10	7	5	2							
78	96	92	88	83	79	75	72	68	64	61	57	54	51	48	45	42	39	36	32	30	27	24	21	19	16	13	11	8	6	4	1						
79	96	92	88	84	80	76	72	68	65	61	58	55	52	48	46	43	40	37	33	31	28	25	22	20	17	15	12	10	7	5	3						
80	96	92	88	84	80	76	72	69	65	62	58	55	52	49	46	43	41	38	34	32	29	26	24	21	18	16	13	11	8	7	5	3					
81	96	92	88	84	80	76	73	69	66	62	59	56	53	49	47	44	41	38	35	33	30	27	25	22	20	17	15	12	10	7	5	3	1				
82	96	92	88	84	80	77	73	70	66	63	59	56	53	50	48	45	42	39	35	33	31	28	26	23	21	18	16	13	11	9	7	4	2				
83	96	92	88	85	81	77	74	70	67	63	60	57	54	51	48	45	42	40	36	34	32	29	27	24	22	19	17	15	12	10	8	6	3	1			
84	96	92	89	85	81	78	74	71	67	64	61	58	55	51	49	46	43	41	37	35	33	30	28	25	23	20	18	16	13	11	9	7	5	3	1		
85	96	92	89	85	81	78	74	71	68	64	61	58	55	52	49	47	44	41	38	36	34	31	29	26	24	22	19	17	15	13	10	8	6	4	2		
86	96	92	89	85	82	78	75	71	68	65	62	59	56	52	50	48	45	42	39	37	35	32	30	27	25	23	20	18	16	14	12	10	7	5	3	1	
87	96	92	89	85	82	79	75	72	68	65	62	59	57	53	51	48	46	43	40	38	36	33	31	28	26	24	22	20	17	15	13	11	9	7	5	3	1
88	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	49	46	44	41	39	37	34	32	29	27	25	23	21	18	16	14	12	10	8	6	4	2
89	96	93	89	85	82	79	76	72	69	66	63	60	57	54	52	49	47	44	42	40	38	35	33	30	28	26	24	22	19	17	15	13	11	9	7	6	4
90	96	92	89	86	82	79	76	73	69	67	63	61	58	55	52	50	47	45	42	40	38	36	34	31	29	27	25	23	20	18	16	14	12	10	8	7	5
91	96	92	89	85	82	80	76	73	70	67	64	61	58	55	53	50	48	45	43	41	39	36	34	32	30	28	25	23	21	19	17	14	12	11	9	7	5
92	96	92	89	85	83	80	76	74	70	68	65	62	59	56	54	51	49	46	44	42	40	37	35	33	31	29	26	24	22	20	18	15	13	11	9	8	6
93	96	93	89	86	83	80	77	74	71	69	65	62	60	57	54	52	49	47	45	43	41	38	36	34	32	30	27	25	23	21	19	16	14	12	10	9	7
94	96	93	89	86	83	80	77	74	72	69	66	63	60	57	54	52	50	47	45	43	41	38	36	34	32	30	28	26	24	22	20	18	15	13	11	10	8
95	96	93	89	85	83	81	77	75	72	69	66	63	61	58	55	52	50	48	46	44	42	39	37	35	33	31	29	27	25	23	21	19	16	14	12	11	9

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Per cent Relative Humidity for Fahrenheit Temperature Differences up to 45°. (continued)

Difference between Wet- and Dry-Bulb Readings, Degrees Fahrenheit : Pressure 30″

Dry-Bulb Reading °F.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
96	96	93	89	86	82	79	76	73	69	66	63	61	58	55	53	50	47	44	42	39	37	35	32	30	28	26	24	22	20	18															
97	96	93	89	86	82	79	76	73	69	66	63	61	58	55	53	50	47	45	42	39	37	35	32	30	28	26	24	22	20	18															
98	96	93	89	86	83	80	76	73	70	67	64	61	58	56	53	50	48	45	43	40	38	36	33	31	29	27	25	23	21	19															
99	96	93	89	87	83	80	77	73	70	67	64	61	59	56	53	51	48	45	43	40	38	36	34	32	29	27	25	23	21	20															
100	96	93	90	89	83	80	77	74	70	68	64	62	59	56	54	49	46	44	41	39	37	35	33	30	28	26	24	22	20	18															
105	97	94	91	88	85	77	74	71	72	69	65	62	60	58	55	52	47	44	42	40	38	35	32	30	28	24	22	20	18	18															
110	97	94	91	88	85	78	75	76	72	69	66	63	60	58	56	52	50	45	42	40	38	36	34	32	30	28	25	23	21	18															
115	97	94	91	88	85	81	78	76	73	70	67	65	61	58	56	54	51	47	44	42	40	38	36	33	31	29	27	25	23	20															
120	97	94	91	89	86	82	79	76	73	70	68	66	63	60	57	54	52	50	46	44	42	40	37	35	33	31	29	27	25	22															
125	98	95	92	89	86	83	80	77	75	72	69	67	65	61	58	56	53	52	50	46	44	42	40	38	36	33	31	29	27	24															
130	98	95	92	89	86	84	81	78	75	73	71	69	65	62	59	57	55	53	51	49	46	44	42	40	38	35	33	31	29	26															
135	98	95	93	90	87	84	81	79	77	74	71	70	67	64	61	59	57	55	53	50	48	46	44	42	40	38	35	33	31	28															
140	98	95	93	90	87	85	82	80	78	75	72	71	68	65	63	60	58	56	54	52	50	48	45	43	41	39	37	35	33	30															
145	98	95	93	91	88	85	83	81	78	76	74	72	69	67	64	62	60	58	56	54	52	50	47	45	43	41	39	37	35	32															
150	98	95	93	91	88	86	84	82	79	77	75	73	71	68	66	63	61	59	57	55	53	51	49	47	45	43	41	39	37	34															
155	98	95	93	91	89	87	85	82	80	78	76	74	72	70	67	65	63	61	59	57	55	53	51	49	47	45	43	41	39	36															
160	98	96	94	91	89	87	85	83	81	79	77	75	73	71	68	66	64	62	61	59	57	55	53	51	49	47	45	43	41	38															
165	98	96	94	92	90	88	86	84	82	80	78	76	74	72	70	68	66	64	62	60	58	57	55	53	51	49	47	45	43	40															
170	98	96	94	92	90	88	86	84	82	80	79	77	75	73	71	69	67	65	64	62	60	58	56	54	52	50	48	46	44	41															
175	98	96	94	92	90	89	87	85	83	81	80	78	76	74	72	70	68	67	65	63	61	59	58	56	54	52	50	48	46	43															
180	98	96	94	93	91	89	87	86	84	82	81	79	77	75	74	72	70	68	66	64	63	61	59	57	55	53	51	49	47	44															
185	98	96	94	93	91	90	88	86	85	83	82	80	78	76	75	73	71	69	67	65	64	62	60	58	56	54	52	50	48	45															
190	98	96	94	93	91	90	88	87	85	84	82	81	79	77	76	74	72	70	68	67	65	63	61	60	58	56	54	52	50	47															
195	98	96	95	94	92	90	89	87	86	84	83	81	80	78	77	75	73	71	70	68	66	64	62	60	59	57	55	53	51	48															
200	98	96	95	94	92	91	89	88	86	85	83	82	80	79	77	76	74	72	70	68	67	65	63	61	60	58	56	54	52	49															
205	98	96	95	94	92	91	90	88	87	85	84	83	81	80	78	76	75	73	71	69	68	66	64	62	60	59	57	55	53	50															
210	98	96	95	94	93	91	90	88	87	86	85	83	82	80	78	77	75	74	72	70	69	67	65	63	61	60	58	56	54	51															

ATOMIC WEIGHTS–PHYSICAL AND CHEMICAL SCALES

Recently the Council of the International Union of Pure and Applied Chemistry resolved that a scale of atomic weights based on the whole number 12, as the atomic weight of the dominant natural isotope of carbon, carbon 12, be adopted.

In the tables which follow atomic weights are given based on carbon, as it occurs naturally, $= 12$. The difference between the atomic weights quoted and those related to $C^{12} = 12$ amounts to less than 43 parts per million. Natural carbon consists of two isotopes, C^{12} and C^{13}, of relative abundance 98·892% and 1·108%. The chemical basis for the atomic weights is thus an average value for the mixture. This is a valid basis for the table since the relative abundance of the two isotopes is practically constant.

In physics it is the behaviour of individual atoms which is of importance, so an average value for their relative weight is not suitable. Consequently, for physical measurements, a new table of atomic weights has been produced based on the one isotope $C^{12} = 12.000$. To avoid confusion in terminology it is the modern practice to give the units of weight on this scale the name atomic mass unit (a.m.u.), e.g. $C^{12} = 12.000$ a.m.u.; 1 a.m.u. $= 1.6598 \times 10^{-24}$ g. Mass spectrographs can determine the relative weights of individual isotopes with high accuracy. Knowing the relative abundance of the carbon isotopes, the average 'atomic weight' of naturally occurring carbon can be found.

giving atomic number, chemical symbol and atomic weight (C = 12·00)

Group 1 A	Group 1 B	Group 2 A	Group 2 B	Group 3 A	Group 3 B	Group 4 A	Group 4 B	Group 5 A	Group 5 B	Group 6 A	Group 6 B	Group 7 A	Group 7 B	Group 8	Group 8	Group 8	Group 0	Electron Orbital No.
1 H 1·0080	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2 He 4·003	2
3 Li 6·940	—	4 Be 9·013	—	5 B 10·81	—	6 C 12·00	—	7 N 14·007	—	8 O 15·999	—	9 F 19·000	—	—	—	—	10 Ne 20·183	2 8
11 Na 22·990	—	12 Mg 24·31	—	13 Al 26·98	—	14 Si 28·09	—	15 P 30·974	—	16 S 32·064	—	17 Cl 35·453	—	—	—	—	18 A. 39·948	2 8 8
19 K 39·102	—	20 Ca 40·08	—	—	21 Sc 44·956	—	22 Ti 47·90	—	23 V 50·94	—	24 Cr 52·00	25 Mn 54·94	—	26 Fe 55·85	27 Co 58·93	28 Ni 58·71	—	2 8 18 8
—	29 Cu 63·54	—	30 Zn 65·37	31 Ga 69·72	—	32 Ge 72·59	—	33 As 74·92	—	34 Se 78·96	—	35 Br 79·909	—	—	—	—	36 Kr 83·80	
37 Rb 85·47	—	38 Sr 87·62	—	—	39 Y 88·90	—	40 Zr 91·22	—	41 Cb (Nb) 92·91	—	42 Mo 95·94	43 Tc [99]	—	44 Ru 101·1	45 Rh 102·90	46 Pd 106·4	—	2 8 18 18 8
—	47 Ag 107·870	—	48 Cd 112·40	49 In 114·82	—	50 Sn 118·69	—	51 Sb 121·75	—	52 Te 127·60	—	53 I 126·90	—	—	—	—	54 Xe 131·30	
55 Cs 132·90	—	56 Ba 137·34	—	—	57-71 Rare Earths (see opposite box)	—	72 Hf 178·49	—	73 Ta 180·95	—	74 W 183·85	75 Re 186·20	—	76 Os 190·2	77 Ir 192·2	78 Pt 195·09	—	2 8 18 32 18 8
—	79 Au 197·0	—	80 Hg 200·59	81 Tl 204·37	—	82 Pb 207·19	—	83 Bi 208·98	—	84 Po [210]	—	85 At [210]	—	—	—	—	86 Rn [222]	
87 Fr [223]	—	88 Ra 226·05	—	—	89-100 Actinium Series (see page 130)	—	—	—	—	—	—	—	—	—	—	—	—	

[] — Mass number of longest lived isotope

The Rare Earths

The Rare Earths				Electron Orbital No.
57 La 138·91	58 Ce 140·12	59 Pr 140·91	60 Nd 144·24	2
				8
61 Pm [147]	62 Sm 150·35	63 Eu 152·0	64 Gd 157·25	18
				32
65 Tb 158·92	66 Dy 162·50	67 Ho 164·93	68 Er 167·26	9
				2
69 Tm 168·93	70 Yb 173·04	71 Lu 174·97	—	

The Actinium Series

The Actinium Series				Electron Orbital No.
89 Ac 227	90 Th 232·04	91 Pa [231]	92 U 238·03	2
				8
93 Np [237]	94 Pu [242]	95 Am [243]	96 Cm [247]	18 32 ?
97 Bk [247]	98 Cf [249]	99 Es [254]	100 Fm [253]	9
				2
101 Mv [256]	102 No [253]	103 Lw [257]	—	

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PROPERTIES OF SOLIDS

Substance	Density (g./cm.³)	Specific heat	Melting point (°C.)	Latent heat of fusion	Coeff. of lin. expansion (× 10⁶)	Thermal conductivity 18° C.	Thermal conductivity 100° C.	Specific resistance (microhm-cm at 18° C.)	Temp. coeff. of resistance
Aluminium	2·70	·216	660·1	93	·23	·480	·492	2·65	·0043
Antimony	6·68	·049	630·5	38·3	·10	·044	·040	40·0	·003
Bismuth	9·80	·030	271·3	12·5	·133	·0194	·0161	106·8 (0° C)	·0045
Brass	8·2–8·8	·089	950–1050	—	·18	~·26		6–9	·001–·002
Brick	1·5–2·0	·2	—	—	·03–·09	~·0015		—	—
Carbon (Graphite)	2·3	·17	3700	—	·079	·012		1375 (0° C)	−·00056 to −·00088
Cobalt	8·9	·10	1492	58·4	·123	·165		5·6	−·0033
Concrete	2·2	~·8	—	—	·1–·15	~·003		—	
Constantan (Eureka)	8·88	·1	1320	—	·17	·054	·064	47	−·00002 to +·00005
Copper	8·96	·092	1083	50·6	·167	·918	·908	1·7	·0039
Cork	·22–·26	·49	—	—	—	·00012		—	
German Silver	8·5–8·9	·095	c. 1050	—	·184	·070	·089	33	·0004
Glass (Crown)	2·5–2·7	·16	1100	—	·090	·0025		~10^{13}	
Glass (Flint)	2·9–4·5	·12	—	—	·079	·002			
Gold	19·3	·0316	1063·0	16·1	·142	·707	·703	2·42	·0034
Ice	·92	·502	0	79·71	·51	·005		3×10^{14}	
India-rubber	·91–·93	·27–·48	—	—	·704	·00045		8×10^{9}	
Invar	8·0	·12	1500	—	·009			81	−·002
Iron (Cast)	7·0–7·7	·119	c. 1100	{Grey 23, White 33}	~·106	~·18		10	
Iron (Wrought)	7·8–7·9	·115	1535	6·3	·117	·144	·143	13·9	·006
Lead	11·34	·03	327·3	—	·287	·083	·082	20·6	·0043
Magnalium	c. 2	·22	610	—	·24	·052	·063	44·5	
Manganin	8·5	·096	—	—	·18				~·00001
Marble	2·5–2·8	·21	—	35·6	·1	·007		6·8	
Naphthalene	1·15	·313	80	73·8	1·07	·00095		3×10^{16}	
Nickel	8·9	·11	1453	35·1	·133	·142	·138	$> 10^{13}$	·006
Paraffin wax	·87–·93	·69	78 (softens)	—	~1·10	·0006		5–10	
Perspex (plasticised)	1·19	·35	1030–1070	27·1	·975	·0005		34·4	·003–·004
Phosphor Bronze	8·8–8·9	—	—	135–260	·17	·060		10·5	·00025
Platinoid	c. 9	—	—	24·3	—	·022		10^{19}–10^{18}	·0038
Platinum	21·45	·0324	1769	24·3	·089 (Pt/Ir ·017)	·166	·173	10·5	
Quartz	2·66	·188	c. 1750	—	·19	1·00	·9919	1·6	·004
Silver	10·5	·056	960·8	24·3	·71			4·5	·00439
Sodium	·97	·295	97·7	27·5	·64	·32		~10^{18}	
Sulphur	2·07	·17–·18	112·8	9·3	·23	·00063		11·5	·005
Tin	7·3	·054	231·9	14·4		·155	·145		
Zinc	7·14	·092	419·5	24·1	·31	·265	·262	5·92	·004

Substance	Density at 0° C. (g./cm.³)	Surface tension with air at 0° C. (dyne per cm.)	Viscosity at 20° C. (dyne per cm.² per unit vel. grad.)	Specific heat at 20° C.	Boiling point (°C.)	Latent heat of vaporization at B.Pt.	Freezing point (°C.)	Coefficient of volume expansion	Thermal conductivity (from 9° to 15° C.)	Electrical resistance (ohm-cm.) at 18° C.	Index of refraction at 15° C. for D line
Alcohol (Ethyl) (C_2H_6O)	·792	22·3	·0119	·60	78·3	204	−114·4	·00110	·000423	3 × 10⁴	1·362
Benzene or Benzole (C_6H_6)	·879 at 20°	28·9	·0065	·41	80·2	95	5·4	·00124	·000333	—	1·501
Bromine (Br)	3·1 at 0°	44	·00993	·11	58·8	43·7	−7·32	·00113	·000343	—	1·66
Carbon Bisulphide (CS_2)	1·292	33	·00363	·24	46·2	85	−110	·00122	·000288	—	1·640
Chloroform ($CHCl_3$)	1·527	27·1	·0058	·23	61·5	58·5	−63	·00126	·000303	—	1·446
Ether ($C_4H_{10}O$)	·736	17	·00234	·54	34·6	83·9	−123	·00166	·000637	—	1·350
Glycerine ($C_3H_8O_3$)	1·26	63·14	13·4	·58	290		18			—	1·473
Hydrochloric Acid (HCl) (20 per cent sol.)	1·10	74		·70	110			·0051		1·3	1·41
Mercury (Hg)	13·595	487	·0156	·033	356·58	70	−38·87	·000182	·019	·0000958	1·73
Nitric Acid (HNO_3) (20 per cent sol.)	1·12	—		·82	104		−65			1·4	1·40
Nitro-benzene ($C_6H_5NO_2$)	1·21	32	·0203	·34	211	79·2	5·7	·00086	·00038		1·553
Olive Oil	·92	—	·84	·47	c. 300		−24	·00070	·00405		1·48
Sulphuric Acid (H_2SO_4) (20 per cent sol.)	1·14	76		·84	105		−38	·00051	·00130	5 × 10¹²	1·35
Turpentine ($C_{10}H_{16}$)	·87	27·3	·0149	·42	156	70	−10	·00097	·000325	1·53	1·48
Water (H_2O)	·99987	72·75	·01002	1·0	100	539·55	0 (0°–33°)	·0002	·00141	{9·1 × 10⁴ (at 4° C.)}	1·333
Water (Sea)	1·025	—		·94	104 (?)		−9			~21	1·343

* The temperature coefficient of resistance of electrolytes is negative, and varies from ·5 per cent to 2 per cent per degree Centigrade.

N.B.—Where not otherwise indicated, the various columns refer to gases at 0° C. and 760 mm. pressure	Density in g. per litre	Viscosity in 10⁻² dyne per cm.² per unit vel. grad. (η)	Critical temp. (°C.) (θc)	Critical pressure in atmos. (Pc)	Critical volume (cm.³) (vc)*	Boiling point at atmos. press. (°C.)	Freezing point (°C.)	Latent heat of vaporization (cal./g.)	Specific heat (constant pressure) (cp)	Ratio of specific heats i.e. $\frac{c_p}{c_v}$ (γ)
Acetylene (C_2H_2)	1·173	93·5	36·0	61·6	4·33	−83·6 (sub. pt.)	−81·8	—	·38	1·26
Air	1·293	183·25/23*	−140·7	37·2	2·86	−190	—	50·97	·237	1·402
Ammonia (NH_3)	·771	91·8	132·4	111·5	4·26	−33·35	−77·7	327·1	·523	1·310
Argon (A)	1·784	210	−122	48	1·88	−186	−189	37·6	·125	1·667
Carbon Dioxide (CO_2)	1·977	140	31·1	73	2·17	−78·5	−65	87	·199	1·304
Carbon Monoxide (CO)	1·250	166	−139	35·0	3·22	−192	−207	50·4	·250	1·404
Chlorine (Cl_2)	3·214	129	144	76·1	1·75	−34·6	−103	67	·114	1·36
Cyanogen (C_2N_2)	2·337	92·8	128	59·0	·00924	−20·7	−35	—	·41	1·26
Ethylene (C_2H_4) (Olefiant Gas)	1·260	90·7	9·7	50·9	4·55	−103	−169	—	·399	1·18
Helium (He)	·1786	186	−239·9	2·26	14·45	−268·9	(†)	6·0	1·25	1·66
Hydrogen (H_2)	·0899	83·5	−239·9	12·8	32·25	−252·8	−259·2	123	3·42	1·41
Hydrogen Chloride (HCl)	1·640	138	51·4	81·6	2·38	−84	−111	98·7	·19	1·40
Hydrogen Sulphide (H_2S)	1·538	117	100·4	88·9	·00578	−61·8	−83	131·9	·243	1·32
Methane (CH_4), (Marsh-Gas) —Fire-Damp}	·717	103	−82·5	45·8	6·17	−164·49	−184	—	·53	1·313
Nitric Oxide (NO)	1·340	178	−94·0	65	1·92	−152	−160·9	—	·232	1·394
Nitrous Oxide (N_2O) (Laughing Gas}	1·978	135	36·5	71·7	2·22	−89·8	−102	67 (−20°)	·213	1·303
Nitrogen (N_2) ‡	1·250	167	−147·1	33·5	3·22	−195·8	−209·9	50	·248	1·404
Oxygen (O_2)	1·429	189	−118·8	49·7	2·33	−182·9	−218·4	58	·218	1·40
Sulphur Dioxide (SO_2)	2·927	117	157·2	77·7	1·92	−10	−73	96·2	·154	1·26
Steam at 100° C.	·581	126	374	217·7	2·5	100		539·55	·482	1·324
Water Vapour (0°)	·80	87						595·9		

* vc = vol. at θc and pc of unit mass of gas = reciprocal of critical density.

† It is believed that helium remains liquid under its own vapour pressure down to 0° Absolute. It can be solidified by the application of 25 atmospheres pressure at about 1° Absolute.

‡ One litre of "atmospheric nitrogen" consists of 988·14 c.c. of pure nitrogen and 11·86 c.c. of argon, and has a weight of 1·257 g.

The volume of 32 g. of oxygen at N.T.P. is 22·415 litres, and this volume of any gas is called a gram-molecular volume, or gram-molecule, or mole, of the gas.

The coefficient of expansion at constant pressure for all ordinary gases may be taken as 1/273, or ·003662. For the perfect gas it is 1/273·2 or ·003661.

PROPERTIES OF THE ELEMENTS

Element	Atomic No.	Symbol	Atomic weight (C = 12)	Valency *	Electro-chemical equivalent (g. per kilocoulomb) †	Density (g./cm.³) at 20° C.	Melting-point (° C.) (temps. above pt. point may be uncertain by over 50°)	Boiling Point (° C.) at 760 mm.
Actinium	89	Ac	227·0	2, 3	1·1766, ·7843	—	1600	—
Aluminium	13	Al	26·98	3	·0932	2·70	660·1	~2500
Americium	95	Am	243	3	—	—	—	—
Antimony	51	Sb	121·75	3, 5	·4207, ·2524	6·7	630·5	1440
Argon	18	A	39·9418	0	—	·00166	−189·3	−186
Arsenic	33	As	74·92	3, 5	·2588, ·1553	5·73	815	sublim. at 616
Astatine	85	At	210	—	—	—	—	—
Barium	56	Ba	137·34	2	·7118	3·5	704	1600
Berkelium	97	Bk	247	—	—	—	—	—
Beryllium	4	Be	9·013	2	·0467	1·8	1280	~3000
Bismuth	83	Bi	208·98	3, 5	·7221, ·4332	9·8	271·3	1477
Boron	5	B	10·81	3	·0374	2·34	2300	2550
Bromine	35	Br	79·909	1	·8282	3·1/25°	−7·2	58·8
Cadmium	48	Cd	112·40	2	·5825	8·65	320·9	768
Caesium	55	Cs	132·90	1	1·3774	1·87	28·4	708
Calcium	20	Ca	40·08	2	·2077	1·54	851	1440
Californium	98	Cf	249	—	—	—	—	—
Carbon	6	C	12·00	4	·0311	2·2	3700	~4700 sub at ~4300
Cerium	58	Ce	140·12	3, 4	·4841, ·3630	6·9	640	2400
Chlorine	17	Cl	35·453	1	·3675	·00321/0°	−101	−34·6
Chromium	24	Cr	52·00	3, 6	·1797, ·0899	7·14	~1830	~2300
Cobalt	27	Co	58·93	2, 3	·3054, ·2032	8·9	1492	3000
Columbium (Niobium)	41	Cb (Nb)	92·91	5	·1926	8·57	~2000	3300
Copper	29	Cu	63·54	1, 2	·6585, ·3293	8·96	1083	2500
Curium	96	Cm	247	—	—	—	—	—
Dysprosium	66	Dy	162·50	3	·5612	—	—	—
Einsteinium	99	Es	254	—	—	—	—	—
Erbium	68	Er	167·26	3	·5776	4·8 (?)	—	—
Europium	63	Eu	152·0	3	·5251	—	—	—
Fermium	100	Fm	253	—	—	—	—	—
Fluorine	9	F	19·00	1	·1969	·00170/0°	−223	−188
Francium	87	Fr	223	—	—	—	—	—
Gadolinium	64	Gd	157·25	3	·5420	5·9	—	—
Gallium	31	Ga	69·72	3	·2409	5·95	29·8	2100
Germanium	32	Ge	72·59	4	·1881	5·4	959	2700
Gold	79	Au	197·0	1, 3	2·0438, ·6813	19·3	1063·0	2950
Hafnium	72	Hf	178·49	4	·4627	13·09	—	5400
Helium	2	He	4·003	0	—	·000166	−271·4 at 30 atm	−268·93
Holmium	67	Ho	164·93	3	·5698	—	—	—
Hydrogen	1	H	1·0080	1	·0104	·00008987/0°	−259·2	−252·8
Indium	49	In	114·82	3	·3964	7·31	156·4	2100
Iodine	53	I	126·90	1	1·3154	4·94	113·7	184·4
Iridium	77	Ir	192·2	4	·5003	22·42	2443	>4800
Iron	26	Fe	55·85	2, 3	·2894, ·1929	7·87	1535	2900
Krypton	36	Kr	83·80	0	—	·00349	−156·6	−152·9
Lanthanum	57	La	138·91	3	·4800	6·15	826	4200
Lawrencium	103	Lw	257	3	—	—	—	—
Lead	82	Pb	207·19	2, 4	1·0738, ·5369	11·34	327·3	1750
Lithium	3	Li	6·940	1	·0719	0·534	186	1400
Lutecium	71	Lu	174·97	3	·6045	—	—	—
Magnesium	12	Mg	24·31	2	·1260	1·741	650	1103

N.B. The Atomic Weights, etc., of the Elements Francium, Astatine, Technetium, Promethium and the trans-uranic elements are not accurately known.

* Valencies given are those of importance in electro-chemical reactions.
† Based on 1 Faraday = 96488 coulombs.

Element	Atomic No.	Symbol	Atomic weight (C = 12)	Valency*	Electro-chemical equivalent (g. per kilo-coulomb)†	Density (g./cm.³) at 20° C.	Melting-point (° C.) (temps. above pt. point may be uncertain by over 50°)	Boiling Point (° C.) at 760 mm.
Manganese	25	Mn	54·94	{2, 3}	{·2846, ·1898}	7·44	1245	2150
Mendelevium	101	Md	256	—	—	—	—	—
Mercury	80	Hg	200·59	{1, 2}	{2·0791, 1·0396}	13·595/0°	−38·87	356·58
Molybdenum	42	Mo	95·94	{4, 6}	{·2486, ·1657}	10·2	2620	4700
Neodymium	60	Nd	144·24	3	·4984	6·96	840	—
Neon	10	Ne	20·183	0	—	·000839	−248·6	−246·3
Neptunium	93	Np	237	—	—	—	—	—
Nickel	28	Ni	58·71	{2, 3}	{·3041, ·2027}	8·9	1453	3100
Nitrogen	7	N	14·007	{3, 5}	{·0484, ·0290}	·001165	−209·9	−195·84
Nobelium	102	No	253	—	—	—	—	—
Osmium	76	Os	190·2	6	·3285	22·48	2700	5500
Oxygen	8	O	15·999	2	·0829	·00133	−218·4	−182·97
Palladium	46	Pd	106·4	{2, 4}	{·5529, ·2765}	12·0	1552	3980
Phosphorus	15	P	30·974	{3, 5}	{·1071, ·0642}	2·2 (red) / 1·8 (yellow)	44·1	279
Platinum	78	Pt	195·09	{2, 4}	{1·0116, ·5058}	21·45	1769	4500
Plutonium	94	Pu	242	—	—	—	—	—
Polonium	84	Po	210·0	2, 4	—	~9·4	254	—
Potassium	19	K	39·102	1	·4052	0·86	63·6	770
Praseodymium	59	Pr	140·91	3	·4868	6·6	940	3300
Promethium	61	Pm	147	—	—	—	—	—
Protactinium	91	Pa	231	3, 4, 5	—	—	~3000	—
Radium	88	Ra	226·05	2	1·1713	~5·0	960 (?)	1140
Radon	86	Rn	222	0	—	·00973/0°	−71	−61·8
Rhenium	75	Re	186·20	—	—	20·5	3167	5900
Rhodium	45	Rh	102·90	3	·3555	12·44	1960	~4500
Rubidium	37	Rb	85·47	1	·8859	1·53	38·8	713
Ruthenium	44	Ru	101·1	{6, 8}	{·1757, ·1316}	12·2	2500	>4000
Samarium	62	Sm	150·35	3	·5196	7·8	>1350	—
Scandium	21	Sc	44·956	3	·1558	2·5	1200	—
Selenium	34	Se	78·96	4	·4097	4·81	220	688
Silicon	14	Si	28·09	4	·0727	2·4	1420	2600
Silver	47	Ag	107·870	1	1·1181	10·5	960·8	2180
Sodium	11	Na	22·990	1	·2383	0·97	97·7	883
Strontium	38	Sr	87·62	2	·4541	2·6	771	1360
Sulphur	16	S	32·064	{2, 4, 6}	{·1662, ·0831}	2·07 (rhombic)	112·8	444·60
Tantalum	73	Ta	180·95	{4, 5}	·3749	16·6	2996	5300
Technetium	43	Tc	99	7	—	—	—	—
Tellurium	52	Te	127·60	{2, 4, 6}	·6613	6·24	450	1390
Terbium	65	Tb	158·92	3	·5500	—	327 (?)	—
Thallium	81	Tl	204·37	{1, 3}	2·1183	11·85	303·5	1460
Thorium	90	Th	232·04	4	·6014	11·7	1842	3500 (?)
Thulium	69	Tm	168·93	3	·5852	—	—	—
Tin	50	Sn	118·69	{2, 4}	{·6151, ·3076}	7·3	231·9	2270
Titanium	22	Ti	47·90	4	·1242	4·54	1660	>3000
Tungsten (see Wolfram)	74							
Uranium	92	U	238·03	{4, 6}	{·6168, ·4112}	18·7	1133	4200
Vanadium	23	V	50·94	{4, 5}	{·1760, ·1056}	5·9	1720	3000 (?)
Wolfram (Tungsten)	74	W	183·85	6	·3177	19·32	3380	6000
Xenon	54	Xe	131·30	0	—	·00550	−111·8	−108·0
Ytterbium	70	Yb	173·04	3	·5978	5·5	1800 (?)	—
Yttrium	39	Y	88·90	3	·3072	5·5	1490	—
Zinc	30	Zn	65·37	2	·3416	7·14	419·5	910
Zirconium	40	Zr	91·22	4	·2363	6·5	1857	5000

* Valencies given are those of importance in electro-chemical reactions.
† Based on 1 Faraday = 96488 coulombs.

INTERNATIONAL TEMPERATURE SCALE 1948
as at April 1957

All fixed points relate to standard atmospheric pressure of 1013250 dyne/cm.^{2} (760 mm. of mercury).

Primary Fixed Points

	° C.
Boiling point of oxygen	−182·970
Freezing point of water	0
Boiling point of water	100
Boiling point of sulphur	444·600
Freezing point of silver	960·8
Freezing point of gold	1063·0

Secondary Fixed Points

	° C.
Sublimation point of solid CO_2	−78·5
Freezing point of mercury	−38·87
Triple point of water	0·0100
Transition point of sodium sulphate decahydrate	32·38
Triple point of benzoic acid	122·36
Boiling point of naphthalene	218·0
Freezing point of tin	231·9
Boiling point of benzophenone	305·9
Freezing point of cadmium	320·9
Freezing point of lead	327·3
Boiling point of mercury	356·58
Freezing point of zinc	419·5
Freezing point of antimony	630·5
Freezing point of aluminium	660·1
Freezing point of copper (in a reducing atmosphere)	1083
Freezing point of nickel	1453
Freezing point of cobalt	1492
Freezing point of palladium	1552
Freezing point of platinum	1769
Freezing point of rhodium	1960
Freezing point of iridium	2443
Freezing point of wolfram (tungsten)	3380

Some Additional Important Temperatures

Absolute zero	0° K.	−273·15 ± ·02° C.*
λ point of helium	2·186° K.	
Boiling point of helium	4·216° K.	
Freezing point of hydrogen	14° K.	−259·2° C.
Boiling point of hydrogen	20·4° K.	−252·8° C.
Freezing point of nitrogen	63·3° K.	−209·9° C.
Boiling point of nitrogen	77·32° K.	−195·8° C.
Freezing point of oxygen	54·8° K.	−218·4° C.

* Presently accepted value. In the U.S.A. the value −273·16° C. is preferred, while the most recent work indicates a value of −273·155 ± 0·015° C.

Dull red heat	500–600° C.
White heat	1500–1800° C.
Estimated temperature of the sun's radiating layers	6000° K.
Estimated temperature of the sun's core	$2 \times 10^{7°}$ K.
Estimated temperature of the radiating layers of the hottest stars	35,000° K.

To convert degrees Celsius (centigrade) to degrees absolute add 273·15.

ATOMIC AND MOLECULAR CONSTANTS

The electronic charge $(e) = 4·803 \times 10^{-10}$ e.s.u. $= 1·602 \times 10^{-20}$ e.m.u. $= 1·602 \times 10^{-19}$ coulombs.

Electronic mass $(m_0) = 9·108 \times 10^{-28}$ g.

Specific electronic charge $\left(\dfrac{e}{m_0}\right) = 5·273 \times 10^{17}$ e.s.u./g. $= 1·759 \times 10^7$

e.m.u./g. $= 1·759 \times 10^8$ coulomb/g.

Mass of hydrogen atom $(M_H) = 1·673 \times 10^{-24}$ g.
Mass of proton $(M_p) = 1·672 \times 10^{-24}$ g.
Mass of neutron $(M_n) = 1·675 \times 10^{-24}$ g.

$\dfrac{M_H}{m_0} = 1837 \qquad \dfrac{M_p}{m_0} = 1836.$

Velocity of light $(c) = 2·998 \times 10^{10}$ cm./s.
Boltzmann's constant $(k) = 1·380 \times 10^{-16}$ erg/degree.
Planck's constant $(h) = 6·625 \times 10^{-27}$ erg second.

$$\hbar = \frac{h}{2\pi} = 1·054 \times 10^{-27} \text{ erg second.}$$

Rydberg constant (for nucleus of infinite mass) $R\infty = 2\pi m_e e^4 h^{-3} c^{-1}$ $= 109737$ cm.$^{-1}$.
Rydberg constant (for hydrogen) $(R_H) = 109677·6$ cm.$^{-1}$.
Volume of 1 gram-molecule (mole) of an ideal at N.T.P. $= 22·415$ litres (chem. scale).

Fine structure constant $\dfrac{1}{\alpha} = 137·04$

Calcite grating space, 20° C. $(d_{20}) = 3·036 \times 10^{-8}$ cm.
Atomic radius $\sim 10^{-8}$ cm. Nuclear radius $\sim 10^{-13}$ cm.

Classical name	Isotope	Particle Emitted	Half value period	Decay constant (λ) (second)$^{-1}$	Parent of	Daughter of
Uranium I (UI)	$_{92}U^{238}$	α	$4{\cdot}51\times10^{9}$ y.	$4{\cdot}873\times10^{-18}$	UX$_1$	—
Uranium X$_1$ (UX$_1$)	$_{90}Th^{234}$	β	$24{\cdot}10$ d.	$3{\cdot}329\times10^{-7}$	UX$_2$	UI
Uranium X$_2$ (UX$_2$)	$_{91}Pa^{234}$	$\beta>99\%$ I.T.~$0{\cdot}15\%$	$1{\cdot}175$ m.	$9{\cdot}832\times10^{-3}$	UII; UZ	UX$_1$
Uranium Z (UZ)	$_{91}Pa^{234}$	β	$6{\cdot}66$ h.	$2{\cdot}891\times10^{-5}$	UII	UX$_2$
Uranium II (UII)	$_{92}U^{234}$	α	$2{\cdot}48\times10^{5}$ y.	$8{\cdot}863\times10^{-14}$	Io	UX$_2$; UZ
Ionium (Io)	$_{90}Th^{230}$	α	$8{\cdot}0\times10^{4}$ y.	$2{\cdot}747\times10^{-13}$	Ra	UII
Radium (Ra)	$_{88}Ra^{226}$	α	1620 y.	$1{\cdot}357\times10^{-11}$	Rn	Io
Radon (Rn)	$_{86}Rn^{222}$	α	$3{\cdot}825$ d.	$2{\cdot}097\times10^{-6}$	RaA	Ra
Radium A (RaA)	$_{84}Po^{218}$	$\alpha>99\%$, $\beta\,0{\cdot}03\%$	$3{\cdot}05$ m.	$3{\cdot}788\times10^{-3}$	RaB; $_{85}At^{218}$	Rn
Radium B (RaB)	$_{82}Pb^{214}$	—	$26{\cdot}8$ m.	$4{\cdot}311\times10^{-4}$	RaC	RaA
—	$_{85}At^{218}$	$\alpha>99\%$, $\beta\sim0{\cdot}1\%$	~2 s.	$0{\cdot}3466$	$_{86}Rn^{218}$	RaA
Radium C (RaC)	$_{83}Bi^{214}$	$\beta>99\%$, $\alpha\,0{\cdot}04\%$	$19{\cdot}7$ m.	$5{\cdot}864\times10^{-4}$	RaC^1; RaC^{11}	RaB; $_{85}At^{218}$
			$0{\cdot}019$ s.	$36{\cdot}48$		
Radium C^1 (RaC^1)	$_{84}Po^{214}$	α	$1{\cdot}637\times10^{-4}$ s.	$4{\cdot}234\times10^{3}$	RaD	RaC; $_{86}Rn^{218}$
Radium C^{11} (RaC^{11})	$_{81}Tl^{210}$	β	$1{\cdot}32$ m.	$8{\cdot}752\times10^{-3}$	RaD	RaC
Radium D (RaD)	$_{82}Pb^{210}$	β	19 y.	$1{\cdot}157\times10^{-9}$	RaE	RaC^1; RaC^{11}
Radium E (RaE)	$_{83}Bi^{210}$	$\beta>99\%$, $\alpha\sim5{\cdot}10^{-4}\%$	$5{\cdot}00$ d.	$1{\cdot}605\times10^{-6}$	Po; $_{81}Tl^{206}$	RaD
Polonium (RaF, or Po)	$_{84}Po^{210}$	α	$138{\cdot}4$ d.	$5{\cdot}797\times10^{-8}$	$_{82}Pb^{206}$	RaE
—	$_{81}Tl^{206}$	β	$4{\cdot}19$ m.	$2{\cdot}757\times10^{-3}$	$_{82}Pb^{206}$	RaE
Uranium lead (RaG)	$_{82}Pb^{206}$	Stable	—	—	—	Po; $_{81}Tl^{206}$

Classical name	Isotope	Particle Emitted	Half value period	Decay constant (λ) (second)$^{-1}$	Parent of	Daughter of
Thorium (Th)	$_{90}Th^{232}$	α	$1{\cdot}39\times10^{10}$ y	$1{\cdot}581\times10^{-18}$	MsTh$_{\rm I}$	—
Mesothorium I (MsTh$_{\rm I}$)	$_{88}Ra^{228}$	β	$6{\cdot}7$ y	$3{\cdot}281\times10^{-9}$	MsTh$_{\rm II}$	Th
Mesothorium II (MsTh$_{\rm II}$)	$_{89}Ac^{228}$	β	$6{\cdot}13$ h.	$3{\cdot}141\times10^{-5}$	RdTh	MsTh$_{\rm I}$
Radiothorium (RdTh)	$_{90}Th^{228}$	α	$1{\cdot}90$ y.	$1{\cdot}157\times10^{-8}$	ThX	MsTh$_{\rm II}$
Thorium X (ThX)	$_{88}Ra^{224}$	α	$3{\cdot}64$ d.	$2{\cdot}204\times10^{-6}$	Tn	RdTh
Thoron (Tn)	$_{86}(Tn\ or\ Rn)^{220}$	α	$54{\cdot}5$ s.	$1{\cdot}272\times10^{-2}$	ThA	ThX
Thorium A (ThA)	$_{84}Po^{216}$	$\alpha>99\%$, $\beta\,0{\cdot}014\%$	$0{\cdot}158$ s.	$4{\cdot}387$	ThB; $_{85}At^{216}$	Tn
—	$_{85}At^{216}$	α	$\sim3\times10^{-4}$ s.	$2{\cdot}311\times10^{3}$	ThC	ThA
Thorium B (ThB)	$_{82}Pb^{212}$	β	$10{\cdot}6$ h.	$1{\cdot}816\times10^{-5}$	ThC	ThA
Thorium C (ThC)	$_{83}Bi^{212}$	$\beta\,66{\cdot}3\%$, $\alpha\,33{\cdot}7\%$	$60{\cdot}5$ m.	$1{\cdot}910\times10^{-4}$	ThC^1; ThC^{11}	ThB; $_{85}At^{216}$
Thorium C^1 (ThC^1)	$_{84}Po^{212}$	α	$3{\cdot}04\times10^{-7}$ s.	$2{\cdot}280\times10^{6}$	ThD	ThC
Thorium C^{11} (ThC^{11})	$_{81}Tl^{208}$	β	$3{\cdot}1$ m.	$3{\cdot}727\times10^{-3}$	ThD	ThC
Thorium lead (ThD)	$_{82}Pb^{208}$	Stable	—	—	—	ThC^1; ThC^{11}

ACTINIUM SERIES $(4n + 3)$

Classical name	Isotope	Particle emitted	Half value period	Decay constant (λ) $(\text{second})^{-1}$	Parent of	Daughter of
Actino-Uranium (AcU)	$_{92}U^{235}$	α	$7\cdot13\times10^{8}$ y.	$3\cdot083\times10^{-17}$	UY	—
Uranium Y (UY)	$_{90}Th^{231}$	β	$25\cdot64$ h.	$7\cdot510\times10^{-6}$	Pa	AcU
Protactinium (Pa)	$_{91}Pa^{231}$	α	$3\cdot43\times10^{4}$ y.	$6\cdot408\times10^{-13}$	Ac	UY
Actinium (Ac)	$_{89}Ac^{227}$	β 98·8%; α 1·2%	22 y.	$9\cdot991\times10^{-10}$	RdAc; AcK	Pa
Radioactinium (RdAc)	$_{90}Th^{227}$	α	18·2 d.	$4\cdot408\times10^{-7}$	AcX	Ac
Actinium X (AcX)	$_{88}Ra^{223}$	α	11·7 d.	$7\cdot163\times10^{-7}$	An	RdAc
Actinium K (AcK)	$_{87}Fr^{223}$	β >99%; α 4×10^{-3}%	21 m.	$5\cdot501\times10^{-4}$	AcX; $_{85}At^{219}$	Ac
Actinon (An)	$_{86}(An\ or\ Rn)^{219}$	α	3·92 s.	$1\cdot768\times10^{-1}$	AcA	AcX
—	$_{85}At^{219}$	α 97%; β 3%	0·9 m.	$1\cdot284\times10^{-2}$	$_{83}Bi^{215}$; An	AcK
—	$_{83}Bi^{215}$	β	8 m.	$1\cdot444\times10^{-3}$	AcA	$_{85}At^{219}$
Actinium A (AcA)	$_{84}Po^{215}$	α >99%; β 5×10^{-4}%	$1\cdot83\times10^{-3}$ s.	$3\cdot788\times10^{2}$	AcB; $_{85}At^{215}$	An; $_{83}Bi^{215}$
	$_{85}At^{215}$	α	$\sim10^{-4}$ s.	$6\cdot932\times10^{3}$	AcC	AcA
Actinium B (AcB)	$_{82}Pb^{211}$	β	36·1 m.	$3\cdot200\times10^{-4}$	AcC	AcA
Actinium C (AcC)	$_{83}Bi^{211}$	α 99·68%; β 0·32%	2·16 m.	$5\cdot348\times10^{-3}$	AcC¹¹; AcC¹	AcB; $_{85}At^{215}$
Actinium C¹ (AcC¹)	$_{84}Po^{211}$	α	0·52 s.	$1\cdot333$	AcD	AcC
Actinium C¹¹ (AcC¹¹)	$_{81}Tl^{207}$	β	4·79 m.	$2\cdot412\times10^{-3}$	AcD	AcC
Actinium lead (AcD)	$_{82}Pb^{207}$	Stable	—	—	—	AcC¹¹; AcC¹

NEPTUNIUM SERIES $(4n + 1)$

Classical name	Isotope	Particle emitted	Half value period	Decay constant (λ) $(\text{second})^{-1}$	Parent of	Daughter of
	$_{94}Pu^{241}$	β >99%; α $\sim10^{-3}$%	13 y.	$1\cdot691\times10^{-9}$	$_{95}Am^{241}$; $_{92}U^{237}$	—
	$_{95}Am^{241}$	α	470 y.	$4\cdot677\times10^{-11}$	$_{93}Np^{237}$	$_{94}Pu^{241}$
	$_{92}U^{237}$	β	6·75 d.	$1\cdot189\times10^{-6}$	$_{93}Np^{237}$	$_{94}Pu^{241}$
	$_{93}Np^{237}$	α	$2\cdot2\times10^{6}$ y.	$9\cdot991\times10^{-15}$	$_{91}Pa^{233}$	$_{95}Am^{241}$; $_{92}U^{237}$
	$_{91}Pa^{233}$	β	27·4 d.	$2\cdot928\times10^{-7}$	$_{92}U^{233}$	$_{93}Np^{237}$
	$_{92}U^{233}$	α	$1\cdot62\times10^{5}$ y.	$1\cdot357\times10^{-13}$	$_{90}Th^{229}$	$_{91}Pa^{233}$
	$_{90}Th^{229}$	α	7340 y.	$2\cdot995\times10^{-12}$	$_{88}Ra^{225}$	$_{92}U^{233}$
	$_{88}Ra^{225}$	β	14·8 d.	$5\cdot421\times10^{-7}$	$_{89}Ac^{225}$	$_{90}Th^{229}$
	$_{89}Ac^{225}$	α	10 d.	$8\cdot023\times10^{-7}$	$_{87}Fr^{221}$	$_{88}Ra^{225}$
	$_{87}Fr^{221}$	α	4·8 m.	$2\cdot407\times10^{-3}$	$_{85}At^{217}$	$_{89}Ac^{225}$
	$_{85}At^{217}$	α	0·018 s.	$38\cdot51$	$_{83}Bi^{213}$	$_{87}Fr^{221}$
	$_{83}Bi^{213}$	β 98%; α 2%	47 m.	$2\cdot458\times10^{-4}$	$_{84}Po^{213}$; $_{81}Tl^{209}$	$_{85}At^{217}$
	$_{84}Po^{213}$	α	$4\cdot2\times10^{-6}$ s.	$1\cdot650\times10^{5}$	$_{82}Pb^{209}$	$_{83}Bi^{213}$
	$_{81}Tl^{209}$	β	2·2 m.	$5\cdot251\times10^{-3}$	$_{82}Pb^{209}$	$_{83}Bi^{213}$
	$_{82}Pb^{209}$	β	3·3 h.	$5\cdot835\times10^{-5}$	$_{83}Bi^{209}$	$_{84}Po^{213}$; $_{81}Tl^{209}$
	$_{83}Bi^{209}$	Stable	—	—	—	$_{82}Pb^{209}$

(at 15° C. and 760 mm. Hg.)

Th	2·48 cm.	U_1	2·70 cm.	AcU	2·9 cm.
					3·08 „
RdTh	3·98 „	U_{11}	3·26 „	Pa	3·52 „
ThX	4·26 „	Io	3·17 „		3·2 „
Tn	5·00 „	Ra	3·28 „	Ac	3·46 „
ThA	5·62 „	Rn	4·06 „	RdAc	4·65 „
					4·30 „
At^{216}	6·93 „	RaA	4·65 „	AcX	4·32 „
ThC	4·76 „	At^{218}	5·52 „	An	5·64 „
ThC^1	8·54 „	RaC	4·0 „	AcA	6·44 „
		RaC^1	6·88 „	At^{215}	7·7 „
		Po	3·84 „	At^{219}	4·9 „
				AcC	5·42 „
Sm^{147}	1·05 „			AcC^1	6·53 „

TABLE OF ISOTOPES AND RELATIVE ABUNDANCE OF THE ELEMENTS

The number of protons in a nucleus is usually designated by Z and is called the *atomic number*. Since the normal atom is electrically neutral, it must contain an equal number of planetary electrons. The chemical properties are determined by the number and arrangement of the electrons and hence the atomic number decides the behaviour of a given atom, i.e. determines which element it is.

The number of neutrons in a nucleus is usually designated by N. The sum, $N + Z$, represents the total number of protons and neutrons in a nucleus and is known as the *mass number*, A.

Atoms which have the same atomic number (i.e. exhibit identical chemical properties) but which have different mass numbers are called *isotopes*.

In the following table the isotopes whose mass numbers are printed in bold-face type occur naturally and if they are radioactive this is shown by an *asterisk* (*). All other isotopes are artificial and are radioactive. The percentage abundance of the natural isotopes is given in parenthesis after the appropriate mass number.

Where no stable isotope of an element is known, the mass number of the longest-lived isotope in the atomic weight column is shown in brackets, e.g. Technetium [99].

Atomic number	Element	Symbol	Atomic weight (C = 12·00)	Mass numbers of the isotopes
1	Hydrogen	H	1·0080	1 (99·985%), 2 (0·015%), 3
2	Helium	He	4·003	3 (~10⁻⁴%), 4 (~100%), 6
3	Lithium	Li	6·940	6 (7·52%), 7 (92·48%), 8, 9
4	Beryllium	Be	9·013	7, 8, 9 (100%), 10
5	Boron	B	10·81	8, 9, 10 (~18·5%), 11 (~81·5%), 12
6	Carbon	C	12·00	10, 11, 12 (98·892%), 13 (1·108%), 14, 15
7	Nitrogen	N	14·007	12, 13, 14 (99·635%), 15 (0·365%), 16, 17
8	Oxygen	O	15·999	14, 15, 16 (99·759%), 17 (0·037%), 18 (0·204%), 19
9	Fluorine	F	19·000	17, 18, 19 (100%), 20, 21
10	Neon	Ne	20·183	18, 19, 20 (90·92%), 21 (0·257%), 22 (8·827%), 23
11	Sodium	Na	22·990	20, 21, 22, 23 (100%), 24, 25
12	Magnesium	Mg	24·31	23, 24 (78·60%), 25 (10·11%), 26 (11·29%), 27, 28
13	Aluminium	Al	26·98	24, 25, 26, 27 (100%), 28, 29
14	Silicon	Si	28·09	27, 28 (92·27%), 29 (4·68%), 30 (3·05%), 31, 32
15	Phosphorus	P	30·974	28, 29, 30, 31 (100%), 32, 33, 34
16	Sulphur	S	32·064	31, 32 (95·018%), 33 (0·750%), 34 (4·215%), 35, 36, 37
17	Chlorine	Cl	35·453	32, 33, 34, 35 (75·4%), 36, 37 (24·60%), 38, 39
18	Argon	A	39·948	35, 36 (0·337%), 37, 38 (0·063%), 39, 40 (99·6%), 41, 42
19	Potassium	K	39·102	37, 38, 39 (93·08%), 40* (0·0119%), 41 (6·911%), 42, 43, 44
20	Calcium	Ca	40·08	39, 40 (96·97%), 41, 42 (0·64%), 43 (0·145%), 44 (2·06%), 45, 46 (0·0033%), 47, 48 (0·185%), 49
21	Scandium	Sc	44·956	40, 41, 43, 44, 45 (100%), 46, 47, 48, 49
22	Titanium	Ti	47·90	43, 44, 45, 46 (7·95%), 47 (7·75%), 48 (73·45%), 49 (5·51%), 50 (5·34%), 51
23	Vanadium	V	50·94	46, 47, 48, 49, 50 (0·24%), 51 (99·76%), 52, 53
24	Chromium	Cr	52·00	48, 49, 50 (4·31%), 51, 52 (83·76%), 53 (9·55%), 54 (2·38%), 55
25	Manganese	Mn	54·93	50, 51, 52, 54, 55 (100%), 56, 57
26	Iron	Fe	55·85	52, 53, 54 (5·84%), 55, 56 (91·68%), 57 (2·17%), 58 (0·31%), 59, 60
27	Cobalt	Co	58·93	54, 55, 56, 57, 58, 59 (100%), 60, 61, 62, 64
28	Nickel	Ni	58·71	56, 57, 58 (67·76%), 59, 60, (26·16%), 61 (1·25%), 62 (3·66%), 63, 64 (1·16%), 65, 66
29	Copper	Cu	63·54	58, 59, 60, 61, 62, 63 (69·1%), 64, 65 (30·9%), 66, 67
30	Zinc	Zn	65·37	62, 63, 64 (48·89%), 65, 66 (27·81%), 67 (4·11%), 68 (18·56%), 69, 70 (0·62%), 71, 72
31	Gallium	Ga	69·72	64, 65, 66, 67, 68, 69 (60·2%), 70, 71 (39·8%), 72, 73
32	Germanium	Ge	72·59	66, 67, 68, 69, 70 (20·55%), 71, 72 (27·37%), 73 (7·67%), 74 (36·74%), 75, 76 (7·67%), 77, 78

Atomic number	Element	Symbol	Atomic weight (C = 12·00)	Mass numbers of the isotopes
33	Arsenic	As	74·92	69, 70, 71, 72, 73, 74, 75 (100%), 76, 77, 78, 79
34	Selenium	Se	78·96	70, 72, 73, 74 (0·87%), 75, 76 (9·02%), 77 (7·58%), 78 (23·52%), 79, 80 (49·82%), 81, 82 (9·19%), 83, 84
35	Bromine	Br	79·909	74, 75, 76, 77, 78, 79 (50·52%), 80, 81 (49·48%), 82, 83, 84, 85, 87, 88, 89
36	Krypton	Kr	83·80	76, 77, 78 (0·354%), 79, 80 (2·27%), 81, 82 (11·56%), 83 (11·55%), 84 (56·90%), 85, 86 (17·37%), 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97
37	Rubidium	Rb	85·47	81, 82, 83, 84, 85 (72·15%), 86, 87* (27·85%), 88, 89, 90, 91, 92, 93, 94, 95, 97
38	Strontium	Sr	87·62	81, 82, 83, 84 (0·563%), 85, 86 (9·86%), 87 (7·02%), 88 (82·56%), 89, 90, 91, 92, 93, 94, 95, 97
39	Yttrium	Y	88·90	82, 83, 84, 85, 86, 87, 88, 89 (100%), 90, 91, 92, 93, 94, 95, 97
40	Zirconium	Zr	91·22	86, 87, 88, 89, 90 (51·46%), 91 (11·23%), 92 (17·11%), 93, 94 (17·4%), 95, 96 (2·8%), 97
41	Columbium } Niobium }	Cb } Nb }	92·91	89, 90, 91, 92, 93 (100%), 94, 95, 96, 97, 98, 99
42	Molybdenum	Mo	95·94	90, 91, 92 (15·86%), 93, 94 (9·12%), 95 (15·70%), 96 (16·50%), 97 (9·45%), 98 (23·75%), 99, 100 (9·62%), 101, 102, 105
43	Technetium	Tc	[99]	92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 105, 107
44	Ruthenium	Ru	101·7	94, 95, 96 (5·7%), 97, 98 (2·2%), 99 (12·8%), 100 (12·7%), 101 (17·0%), 102 (31·3%), 103, 104 (18·3%), 105, 106, 107
45	Rhodium	Rh	102·90	95, 97, 98, 99, 100, 101, 102, 103 (100%), 104, 105, 106, 107, 109
46	Palladium	Pd	106·4	100, 101, 102 (0·8%), 103, 104 (9·3%), 105 (22·6%), 106 (27·2%), 107, 108 (26·8%), 109, 110 (13·5%), 111, 112, 113
47	Silver	Ag	107·870	102, 103, 104, 105, 106, 107 (51·35%), 108, 109 (48·65%), 110, 111, 112, 113, 114, 115
48	Cadmium	Cd	112·40	104, 105, 106 (1·215%), 107, 108 (0·875%), 109, 110 (12·39%), 111 (12·75%), 112 (24·07%), 113 (12·24%), 114 (28·86%), 115, 116 (7·58%), 117, 118
49	Indium	In	114·82	107, 108, 109, 110, 111, 112, 113 (4·23%), 114, 115* (95·77%), 116, 117, 118, 119
50	Tin	Sn	118·69	108, 110, 112 (0·95%), 113, 114 (0·65%), 115 (0·34%), 116 (14·24%), 117 (7·57%), 118 (24·01%), 119 (8·58%), 120 (32·97%) 121, 122 (4·71%), 123, 124 (5·98%), 125, 126, 127

Atomic number	Element	Symbol	Atomic weight (C=12.00)	Mass numbers of the isotopes
51	Antimony	Sb	121·75	116, 117, 118, 119, 120, **121** (57·25%), 122, 123 (42·75%), 124, 125, 126, 127, 129, 130, 131, 132, 133, 134, 135
52	Tellurium	Te	127·60	117, 118, 119, 120 (0·089%), 121, 122 (2·46%), 123 (0·87%), **124** (4·61%), **125** (6·99%), **126** (18·71%), 127, **128** (31·79%), 129, **130** (34·49%), 131, 132, 133, 134, 135
53	Iodine	I	126·90	119, 120, 121, 122, 123, 124, 125, 126, **127** (100%), 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139
54	Xenon	Xe	131·3	121, 122, 123, **124** (0·096%), 125, **126** (0·09%), 127, **128** (1·919%), **129** (26·44%), **130** (4·08%), **131** (21·18%), **132** (26·89%), 133, **134** (10·44%), 135, **136** (8·87%), 137, 138, 139, 140, 141, 143, 144
55	Caesium	Cs	132·90	123, 125, 126, 127, 128, 129, 130, 131, 132, **133** (100%), 134, 135, 136, 137, 138, 139, 141, 142, 143, 144
56	Barium	Ba	137·34	126, 127, 128, 129, **130** (0·101%), 131, **132** (0·097%), 133, **134** (2·42%), **135** (6·59%), **136** (7·81%), **137** (11·32%), **138** (71·66%), 139, 140, 141, 142, 143, 144
57	Lanthanum	La	138·91	131, 132, 133, 134, 135, 136, 137, 138* (0·089%), **139** (99·911%), 140, 141, 142, 143, 144
58	Cerium	Ce	140·12	133, 134, 135, **136** (0·193%), 137, **138** (0·25%), 139, **140** (88·48%), 141, **142** (11·07%), 143, 144, 146
59	Praseodymium	Pr	140·91	135, 136, 137, 138, 139, 140, **141** (100%), 142, 143, 144, 146
60	Neodymium	Nd	144·24	138, 139, 140, 141, **142** (27·13%), **143** (12·20%), **144** (23·87%), **145** (8·30%), **146** (17·18%), 147, **148** (5·72%), 149, 150* (5·10%), 151
61	Promethium	Pm	[147]	141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151
62	Samarium	Sm	150·35	143, **144** (3·16%), 145, **147*** (15·07%), **148** (11·27%), **149** (13·84%), **150** (7·47%), 151, **152** (26·63%), 153, **154** (22·53%), 155, 156
63	Europium	Eu	152·0	144, 145, 146, 147, 148, 149, 150, **151** (47·77%), 152, **153** (52·23%), 154, 155, 156, 157, 158, 159
64	Gadolinium	Gd	157·25	148, 149, 150, 151, **152** (0·20%), 153, **154** (2·15%), **155** (14·73%), **156** (20·47%), **157** (15·68%), **158** (24·87%), 159, **160** (21·90%), 161
65	Terbium	Tb	158·92	149, 151, 153, 154, 155, 156, 157, **159** (100%), 160, 161, 162, 163
66	Dysprosium	Dy	162·50	**156** (0·0524%), 157, **158** (0·0902%), 159, **160** (2·294%), **161** (18·88%), **162** (25·53%), **163** (24·97%), **164** (28·18%), 165, 166

Atomic number	Element	Symbol	Atomic weight (C=12.00)	Mass numbers of the isotopes
67	Holmium	Ho	164·93	160, 161, 162, 163, 164, **165** (100%), 166
68	Erbium	Er	167·26	160, 161, **162** (0·136%), 163, **164** (1·56%), 165, **166** (33·41%), **167** (22·94%), **168** (27·07%), 169, **170** (14·88%), 171
69	Thulium	Tm	168·93	165, 166, 167, 168, **169** (100%), 170, 171, 172
70	Ytterbium	Yb	173·04	166, **168** (0·14%), 169, **170** (3·03%), **171** (14·31%), **172** (21·82%), **173** (16·13%), **174** (31·84%), 175, **176** (12·73%), 177
71	Lutecium	Lu	174·97	170, 171, 172, 173, 174, **175** (97·4%), 176* (2·6%), 177
72	Hafnium	Hf	178·49	170, 171, 172, 173, **174** (0·18%), 175, **176** (5·15%), **177** (18·39%), **178** (27·08%), **179** (13·78%), **180** (35·44%), 181
73	Tantalum	Ta	180·95	176, 177, 178, 179, 180* (0·0123%), **181** (99·988%), 182, 183, 184, 185
74	Wolfram (Tungsten)	W	183·85	176, 177, 178, 179, **180** (0·135%), 181, **182** (26·4%), **183** (14·4%), **184** (30·6%), 185, **186** (28·4%), 187, 188
75	Rhenium	Re	186·20	180, 182, 183, 184, **185** (37·07%), 186, **187*** (62·93%), 188, 189
76	Osmium	Os	190·2	182, 183, **184** (0·018%), 185, **186** (1·59%), **187** (1·64%), **188** (13·3%), **189** (16·1%), **190** (26·4%), 191, **192** (41·0%), 193, 194
77	Iridium	Ir	192·2	187, 188, 190, **191** (38·5%), 192, **193** (61·5%), 194, 195, 196, 197, 198
78	Platinium	Pt	195·09	188, 190* (0·012%), 191, **192** (0·78%), 193, **194** (32·8%), **195** (33·7%), **196** (25·4%), 197, **198** (7·23%), 199
79	Gold	Au	197·0	191, 192, 193, 194, 195, 196, **197** (100%), 198, 199, 200, 201, 202, 203, 204
80	Mercury	Hg	200·59	189, 190, 191, 192, 193, 194, 195, **196** (0·146%), 197, **198** (10·02%), **199** (16·84%), **200** (23·13%), **201** (13·22%), **202** (29·80%), 203, **204** (6·85%), 205
81	Thallium	Tl	204·37	196, 197, 198, 199, 200, 201, 202, **203** (29·5%), 204, **205** (70·5%), 206* (AcC"), 208* (ThC"), 209, 210* (RaC")
82	Lead	Pb	207·19	198, 199, 200, 201, 203, **204** (1·48%), 206 (23·6%), **207** (22·6%), 208 (52·3%), 209, 210* (RaD), 211* (AcB), 212* (ThB), 214* (RaB)
83	Bismuth	Bi	208·98	198, 199, 200, 201, 202, 203, 204, 205, 206, 207, **209** (100%), 210* (RaE), 211* (AcC), 212* (ThC), 213, 214* (RaC), 215

TABLE OF ISOTOPES (continued)

Atomic number	Element	Symbol	Atomic weight (C=12.00)	Mass numbers of the isotopes
84	Polonium	Po	[210]	200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210*, 211* (AcC'), 212* (ThC'), 213, 214* (RaC'), 215* (AcA), 216* (ThA), 217, 218 (RaA)
85	Astatine	At	[210]	203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215*, 216*, 217, 218*, 219*
86	Radon	{ Rn Em }	[222]	208, 209, 210, 211, 212, 215, 216, 217, 218, 219* (An), 220* (Tn), 221, 222* (Rn)
87	Francium	Fr	[223]	211, 212, 217, 218, 219, 220, 221, 222, 223* (AcK)
88	Radium	Ra	226·05	213, 219 220, 221, 222, 223* (AcX), 224* (ThX), 225, 226*, 227, 228* (MsThi), 229, 230
89	Actinium	Ac	227	221, 222, 223, 224, 225, 226, 227*, 228* (MsTh2), 229, 230
90	Thorium	Th	232·04	223, 224, 225, 226, 227* (RdAc), 228* (RdTh), 229, 230* (Io), 231* (UY), 232*, 233, 234* (UX1), 235
91	Protactinium	Pa	[231]	225, 226, 227, 228, 229, 230, 231*, 232, 233, 234* (UX2), 234* (UZ) 235, 237
92	Uranium	U	238·03	227, 228, 229, 230, 231, 232, 233, 234* (UII), 235* (AcU), 236, 237, 238* (UI), 239, 240
93	Neptunium	Np	[237]	231, 232, 233, 234, 235, 236, 237, 238, 239, 240
94	Plutonium	Pu	[242]	232, 234, 235, 236, 237, 238, 239(†), 240, 241, 242, 243, 244
95	Americium	Am	[243]	237, 238, 239, 240, 241, 242, 243, 244
96	Curium	Cm	[247]	238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248
97	Berkelium	Bk	[247]	243, 244, 245, 246, 247, 249
98	Californium	Cf	[249]	244, 245, 246, 247, 248, 249, 250, 251, 252, 253
99	Einsteinium	E	[254]	246, 247, 253, 254, 255
100	Fermium	Fm	[253]	254, 255, 256
101	Mendelevium	Mv	[256]	256
102	Nobelium	No	[253]	
103	Lawrencium	Lw	[257]	

(†) This isotope has been found in pitchblende in a concentration of 1 part in 10^{12}.

THE PARTICLES OF MODERN PHYSICS

Name	Symbol	Rest mass (electron mass = 1)	Lifetime	Mode of decay	First observer	Description
Photon	$h\nu$	0	Stable	—	Postulated by Planck in 1901 to account for observed energy distribution of thermal radiation. Used by Einstein 1905 to explain the photoelectric effect discovered by Hertz in 1887.	The quantum of radiation or particle of radiant energy. Energy $E = h\nu$, where $h =$ Planck's constant and $\nu =$ frequency of the electromagnetic radiation.
Neutrino	ν_0	Probably 0. Certainly less than 0·0004	—	—	Postulated by Pauli 1931 to conserve energy and spin in β-decay. Name proposed by Fermi. Experimentally detected 1956 by Reines and Cowan through the reaction $p^+ + \nu_0 \to n_0 + e^+$	For 25 years a hypothetical neutral particle invoked to conserve energy and momentum in many types of nuclear reactions. Has extremely small cross-section for interaction with matter.
Electron	e^-	1	Stable	—	J. J. Thomson, 1897.	Negatively charged particle. On Bohr model of atom, electrons revolve in orbits round the central nucleus.
Positron	e^+	1	Stable (see description)	—	Anderson et al. 1932. Postulated by Dirac, 1931 on theoretical grounds.	Observed first in cosmic radiation. Similar to electron but bears positive charge. Interacts strongly with and is annihilated by combination with a negative electron producing two oppositely directed quanta each of which has energy $= 511$ keV. $e^- + e^+ \to 2h\nu$.

THE PARTICLES OF MODERN PHYSICS (*continued*)

Name	Symbol	Rest mass electron mass = 1	Lifetime	Mode of decay	First observer	Description
LIGHT (L) MESONS						
μ-meson	μ^+ μ^-	207 207	$2\cdot10^{-6}$ s. $2\cdot10^{-6}$ s.	$\mu^+ \rightarrow e^+ + 2v_0$ $\mu^- \rightarrow e^- + 2v_0$	Anderson et al., 1936-38.	Observed first in cosmic radiation. Is found in decay of π-meson. May be captured if stops close to heavy nucleus causing disruption thereof.
π-meson	π^+ π^- π^0	273 273 264	$2\cdot10^{-8}$ s. $2\cdot10^{-8}$ s. 5×10^{-14} s.	$\pi^+ \rightarrow \mu^+ + v_0$ $\pi^- \rightarrow \mu^- + v_0$ $\pi^0 \rightarrow 2hv$	Lattes, Muirhead, Occhialini and Powell, 1947. Bjorklund et al., 1950. (Mesons having similar properties to π-mesons were postulated on theoretical grounds by Yukawa 1935).	Charged π-mesons particularly the π-, interact strongly with nuclei causing the disruption thereof. First observed in cosmic radiation, they can now be produced artificially by high energy accelerators.
K PARTICLES						
τ-meson	τ^+ } τ^- }		$\sim1\cdot0 \times 10^{-8}$ s.	$\tau^+ \rightarrow 2\pi^+ + \pi^-$ $\tau^- \rightarrow 2\pi^- + \pi^+$ (in flight)	Brown et al., 1949	It is now believed that the various 'K-particles' are not distinct mesons but are the several disintegration modes of one particle.
θ-meson (formerly χ-meson)	θ_0 θ^+	} 965	$0\cdot66 \times 10^{-10}$ s. $\sim10^{-8}$ s.	$\theta_0 \rightarrow \pi^+ + \pi^-$ $\theta^+ \rightarrow \pi^+ + \pi^0$	Menon et al., 1952	
K_μ-meson K_β-meson	K_μ^+ K_β^+		$9\cdot0 \times 10^{-9}$ s. ?	$K_\mu^+ \rightarrow \mu^+ + v_0$ $K_\beta^+ \rightarrow e^+ + 2$ neutral particles	Gregory et al., 1954 Friedlander et al., 1954	
κ-meson	κ^+		$\sim10^{-8}$ s.	$\kappa^+ \rightarrow \mu^+ + 2$ neutral particles	O'Ceallaigh, 1951	

NUCLEONS

Proton	p^+	1836	Stable	—	Rutherford, 1911; Marsden, 1913	The nucleus of the hydrogen atom ($_1H^1$). A component of all nuclei. Carries a single positive charge.
Neutron	n_0	1838	12 m.	$n_0 \rightarrow p^+ + e^- + v_0$	Chadwick, 1932	The neutral particle present in every nucleus save ($_1H^1$).

ANTINUCLEONS

Antiproton	p^-	1836 ± 40	Stable in vacuum	Annihilates with p^+	Chamberlain et al., Amaldi et al., 1955/56	The antiparticles have the same mass as the ordinary particles but opposite charge (where appropriate) and opposite magnetic moment, z component of the isotopic spin, etc.
Antineutron	n_0	~1838	—	—	—	

HYPERONS

Λ_0-meson (formerly called V^0)	Λ_0	2182 ± 0·4	$3\cdot4 \times 10^{-10}$ s.	$\Lambda_0 \rightarrow p^+ + \pi^-$	Armenteros et al., 1951	Hyperon is the name given to all particles of mass intermediate to that of the neutron and deuteron.
Σ^+-meson Σ^-	Σ^+ Σ^-	2327 ± 1 2340	$0\cdot3 \times 10^{-10}$ s. $1\cdot4 \times 10^{-10}$ s.	$\Sigma^+ \rightarrow \pi^+ + n_0$ $\Sigma^- \rightarrow p^+ + \pi^0$	Bonetti et al., 1953 York et al., 1953 Shutt et al., 1954	—
Ξ-meson	Ξ^-	2585 ± 6	$\sim10^{-10}$ s.	$\Xi^- \rightarrow \Lambda_0 + \pi^-$	Cowan et al., 1954	—

Einstein's relation $E = mc^2$ relates mass and energy with the square of the speed of light as the constant of proportionality. Thus the energy equivalent of 1 g. of any substance is $8·988 \times 10^{20}$ ergs $= 8·988 \times 10^{13}$ joules $= 2·497 \times 10^7$ kilowatt-hours. This amount of energy would be liberated if 1 g. of matter was annihilated.

It is often convenient to consider energies in terms of electron-volts (e.v.). One electron volt is the energy gained by any singly charged particle (such as an electron) in falling through a potential difference of 1 volt.

One volt $= 10^8$ e.m.u. of potential and the electronic charge is $1·602 \times 10^{-20}$ e.m.u. So the energy of 1 e.v. $= 10^8 \times 1·602 \times 10^{-20} = 1·602 \times 10^{-12}$ erg.

1 k.e.v. = 1000 e.v. 1 M.e.v. = 10^6 e.v.

For gas atoms in thermal equilibrium with one another the energy per degree of freedom is $\frac{1}{2}kT$, where k is Boltzmann's constant and T is the absolute temperature. For an atom with three degrees of freedom, the energy is $\frac{3}{2}kT$. For molecules there are more than three degrees of freedom in general. This relation is not valid for temperatures near the absolute zero where quantum considerations enter. In chemistry and in thermodynamics energies are often in terms of kT. In the table below the energy equivalent of one degree absolute is calculated from $E = kT$.

The table given on p. 155 is suitable for converting most of the commonly encountered energy units. It gives equivalent quantities in horizontal lines. Thus 1 g. $= 8·988 \times 10^{20}$ ergs $= 1·098 \times 10^{27}$ electron masses $= 6·025 \times 10^{23}$ a.m.u. $= 5·610 \times 10^{26}$ M.e.v. $= 6·511 \times 10^{36}$ deg. abs. etc.

The table may be further extended to include the energy-frequency and the energy-wave number relation of photons through $E = h\nu$ and $E = hc\left(\dfrac{1}{\lambda}\right)$, where $\dfrac{1}{\lambda}$ is the wave number. Thus a photon of unit frequency has an energy of $6·625 \times 10^{-27}$ erg while one having unit wave number has an energy of $1·986 \times 10^{-16}$ erg.

ENERGY EQUIVALENTS

	Ergs	Grams	Electron masses	a.m.u.	M.e.v.	Degrees absolute	Calories	K.W.H.
1 erg =	1	$1·113 \times 10^{-21}$	$1·222 \times 10^{6}$	$6·704 \times 10^{2}$	$6·242 \times 10^{5}$	$7·244 \times 10^{15}$	$2·389 \times 10^{-8}$	$2·778 \times 10^{-14}$
1 gram =	$8·988 \times 10^{20}$	1	$1·098 \times 10^{27}$	$6·025 \times 10^{23}$	$5·610 \times 10^{26}$	$6·511 \times 10^{36}$	$2·147 \times 10^{13}$	$2·497 \times 10^{7}$
1 electron mass =	$8·186 \times 10^{-7}$	$9·108 \times 10^{-28}$	1	$5·488 \times 10^{-4}$	$0·5110$	$5·930 \times 10^{9}$	$1·956 \times 10^{-14}$	$2·274 \times 10^{-20}$
1 a.m.u. =	$1·492 \times 10^{-3}$	$1·660 \times 10^{-24}$	1822	1	$931·1$	$1·081 \times 10^{13}$	$3·564 \times 10^{-11}$	$4·144 \times 10^{-17}$
1 M.e.v. =	$1·602 \times 10^{-6}$	$1·783 \times 10^{-27}$	$1·957$	$1·074 \times 10^{-3}$	1	$1·161 \times 10^{10}$	$3·828 \times 10^{-14}$	$4·450 \times 10^{-20}$
1 deg. abs. =	$1·380 \times 10^{-16}$	$1·536 \times 10^{-37}$	$1·686 \times 10^{-10}$	$9·254 \times 10^{-14}$	$8·617 \times 10^{-11}$	1	$3·298 \times 10^{-24}$	$3·835 \times 10^{-30}$
1 calorie =	$4·186 \times 10^{7}$	$4·657 \times 10^{-14}$	$5·113 \times 10^{13}$	$2·806 \times 10^{10}$	$2·613 \times 10^{13}$	$3·032 \times 10^{23}$	1	$1·163 \times 10^{-6}$
1 K.W.H. =	$3·600 \times 10^{13}$	$4·006 \times 10^{-8}$	$4·398 \times 10^{19}$	$2·413 \times 10^{16}$	$2·247 \times 10^{19}$	$2·608 \times 10^{29}$	$8·601 \times 10^{5}$	1

OPTICAL DATA

REFRACTIVE INDEX OF GASES

for D line = 5893 Å.

Acetylene	1·000606	Hydrogen	1·000138
Air	1·000292	Hydrogen chloride	1·000447
Ammonia	1·000375	Hydrogen sulphide	1·000630
Argon	1·000281	Methane	1·000441
Carbon dioxide	1·000450	Nitric oxide	1·000297
Carbon monoxide	1·000334	Nitrous oxide	1·000515
Chlorine	1·000768	Nitrogen	1·000297
Cyanogen	1·000800	Oxygen	1·000272
Ethylene	1·000674	Sulphur dioxide	1·000660
Helium	1·000036	Water vapour	1·000254

REFRACTIVE INDICES (AGAINST AIR) FOR MEAN D LINE

$\lambda = 5893 \times 10^{-8}$ cm.

Canada Balsam	1·53	Iceland Spar (ord.)	1·658
Crown Glass	1·48–1·61	Iceland Spar (ext.)	1·486
Diamond	2·417	Quartz (ord.)	1·544
Felspar	1·52	Quartz (ext.)	1·553
Flint Glass	1·53–1·96	Rock Salt	1·544
Fluorspar	1·434	Ruby	1·76
Ice	1·31	Sylvine (KCl)	1·490
Water	1·333	Perspex	1·495

WAVELENGTHS OF IMPORTANT SPECTRAL LINES IN AIR AT 15° C. AND 760 mm.

Å. = 10^{-8} cm. = Ångström unit

Line	Wavelength Å	Line	Wavelength Å
K red	7668	Mg green (b_1)	5178
O red (A)	7594	Mg green (b_2)	5173
O red (B)	6870	Mg green (b_4)	5167
Li red	6708	Cd green*	5085·82
Hα red (C)	6563	Hβ blue-green (F)	4861
Cd red*	6438·4696	Cd blue*	4799·91
Li orange	6104	Sr blue	4608
Na orange (D_1)	5895·9	Li blue	4602
Na orange (D_2)	5890·0	Hγ blue (G¹)	4340
He yellow (D_3)	5875·6	Fe and Ca blue (G)	4308
Tl green	5351	Ca blue (g)	4227
Fe and Ca green (E)	5270	K violet	4047

* Accepted standard lines

Rydberg's Constant – Hydrogen, 109677·58; Helium, 109722·27

Velocity of Light in Vacuum (c) = 299793 ± 0·5 km./s.

THE ELECTROMAGNETIC SPECTRUM

γ-rays

X-rays

Ultra-violet

VISIBLE

Infra Red

Radio, T.V. and Radar

A.C.

Freq. Kc/s

Wavelength (metres)
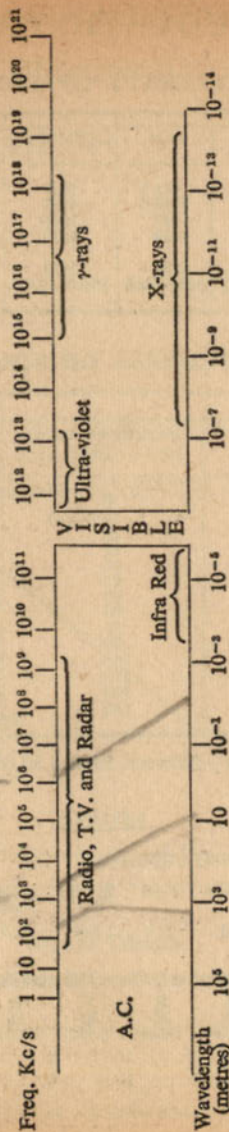
2000M — 150 Kc/s
10m — 30 Mc/s
70cm — 440 Mc/s (approx)
21cm — 1420 Mc/s

1 Mc/s
1 Gc/s

ACOUSTIC DATA

VELOCITY OF SOUND

Substance	Temp.	m./s.	ft./s.	Substance	m./s.	ft./s.
Air	0° C.	331·3	1087	Aluminium	5100	16730
Hydrogen	0° C.	1270·0	4166	Brass	3500	11480
Oxygen	0° C.	317	1040	Copper	3600	11810
Water	20° C.	1410	4626	Iron	5000	16400
Oak (along fibre)	10°–20° C.	3850	12630	Lead	1300	4265
Glass	10°–20° C.	5000–6000	16400–19700	Mercury	1452	4764

LOUDNESS OF SOUNDS

Intensity in terms of threshold-intensity = ·0002 dyne per cm.²	Intensity in decibels	Loudness in phons
1	0	0 Threshold of hearing
10	10 (1 bel)	10 Virtual silence
10^2	20	20 Quiet room
10^3	30	30 Watch ticking at 3 ft.
10^4	40	40 Quiet street
10^5	50	50 Quiet conversation
10^6	60	60 Quiet motor at 3 ft.
10^7	70	70 Loud conversation
10^8	80	80 Door slamming
10^9	90	90 Busy typing room
10^{10}	100	100 Near loud motor horn
10^{11}	110	110 Pneumatic drill
10^{12}	120	120 Near aeroplane engine
10^{13}	130	130 Threshold of pain

Limits of Audibility – Between 30 and 30,000 c/s. (approximately).

MUSIC

The consonant frequency intervals.

Name	Octave	Fifth	Fourth	Major Third	Major Sixth	Minor Third	Minor Sixth
Frequency Ratio	1:2	2:3	3:4	4:5	3:5	5:6	5:8

Musical Scales – Vibration Ratios

	C	D	E	F	G	A	B	C
Basic* Scale }	24	27	30	32	36	40	45	48
	1·000	1·125	1·250	1·333	1·500	1·667	1·875	2·000
Intervals	—	$\frac{9}{8}$	$\frac{10}{9}$	$\frac{16}{15}$	$\frac{9}{8}$	$\frac{10}{9}$	$\frac{9}{8}$	$\frac{16}{15}$

* The Basic Scale is frequently referred to as the Natural or Diatonic Scale.

GEOMETRICAL MENSURATIONS

(Illustrated)
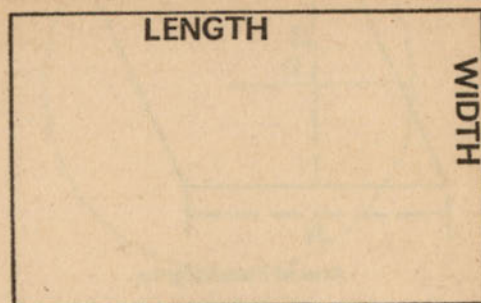
Area of Rectangle

Area of rectangle equals LENGTH × WIDTH.
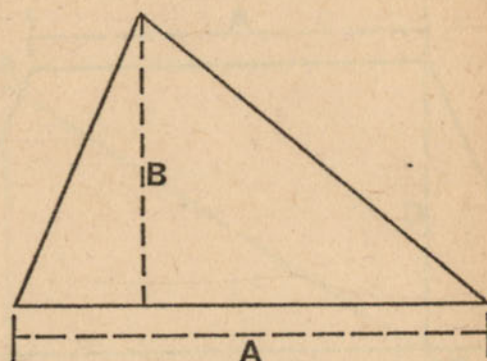
Area of Triangle

Area of any triangle equals the length of the base multiplied by half the vertical height.

i.e. If A equals length of base and B equals vertical height, area equals $\frac{A \times B}{2}$.
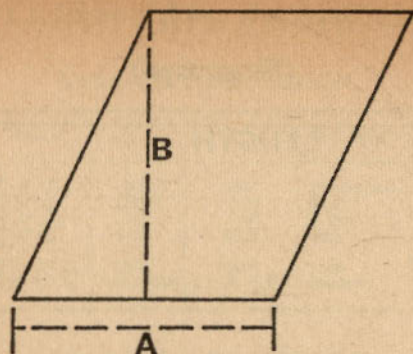
Area of Parallelogram

Area of a parallelogram equals the length of one of the sides multiplied by the perpendicular height.

i.e. If A equals length of one side and B equals perpendicular height, area equals A × B.
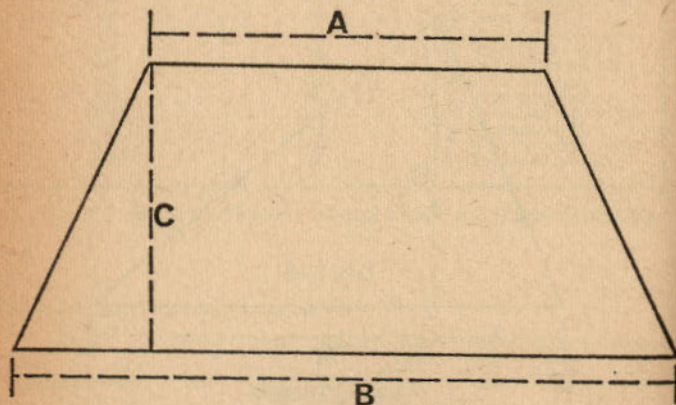
Area of Trapezoid

Area of a trapezoid equals half the sum of the two parallel sides multiplied by the perpendicular distance between them.

i.e. If A and B equal the lengths of the two parallel sides and C equals the perpendicular distance between them, area equals $\dfrac{A + B}{2} \times C$.

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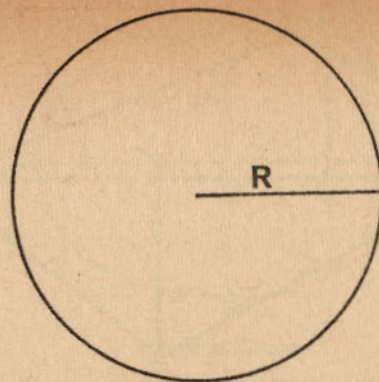
Area of Circle

Area of a circle is proportional to the square of its radius.

i.e. If R equals the radius of the circle, area equals πR^2 (π, a constant quantity $= \dfrac{22}{7}$ or 3·1416).
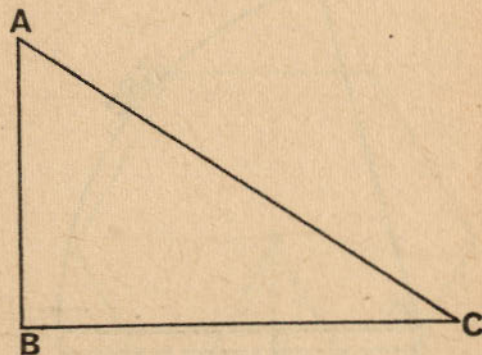
Determination of Height, Base, or Hypothenuse of a Right-angled Triangle

If AB = height, BC = base, and AC = hypothenuse, when two dimensions are given:

$$\text{Base} = \sqrt{AC^2 - AB^2} \quad \text{Height} = \sqrt{AC^2 - BC^2}$$
$$\text{Hypothenuse} = \sqrt{BC^2 + AB^2}$$

161
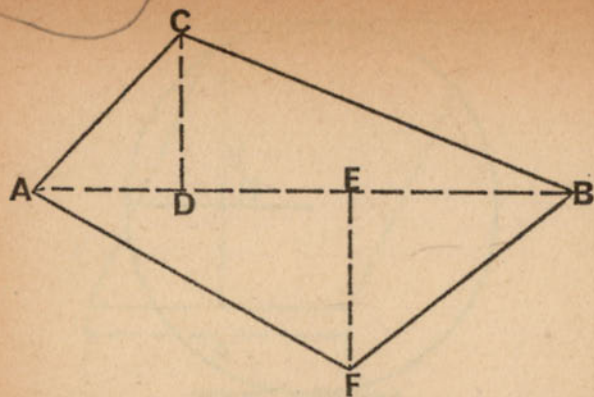
Area of Trapezium

Area of a trapezium equals the length of the diagonal multiplied by half the sum of the perpendiculars let fall upon it from its opposite angles.

i.e. If AB equals the length of the diagonal and CD + EF equals the sum of the perpendiculars to the opposite angles, area equals

$$AB \times \frac{CD + EF}{2}.$$
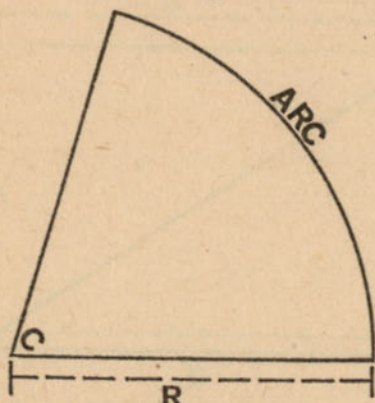
Area of Sector of Circle

Area of sector of circle equals area of the full circle multiplied by the degrees in ARC and divided by 360.

i.e. If R equals radius and C equals degrees in ARC, area equals

$$\frac{R^2 \times \pi \times C}{360}.$$

162
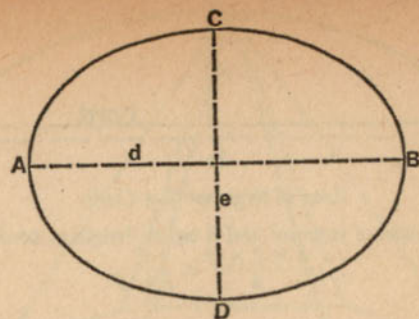
Area of Ellipse

Area of an ellipse equals half the larger axis multiplied by half the smaller axis and multiplied by π.

i.e. If AB be the larger axis and d be half of it: and if CD be the smaller axis and e be the half of it, area equals $d \times e \times \pi$.

An approximate formula for the Circumference of an ellipse is

$$C = \pi \left(\frac{\sqrt{d^2 + e^2}}{2} + \frac{d + e}{2} \right).$$
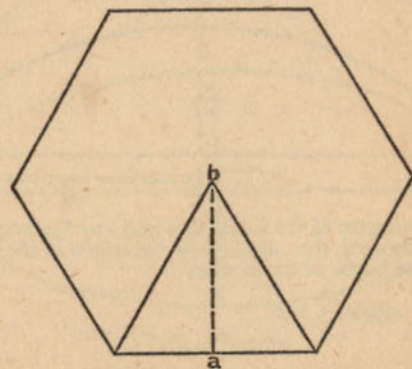
Area of Regular Polygon

Divide the polygon into triangles; find the area of one triangle and multiply by the number of triangles contained in the polygon.

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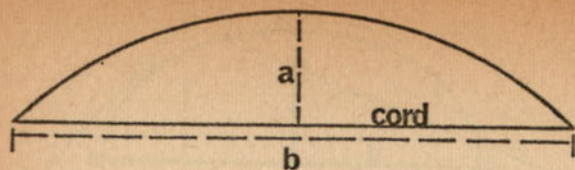
Area of Segment of a Circle

If *a* equals height of segment and *b* equals length of cord, area equals

$$\frac{a \times 2 \times b}{3} \times \frac{a^3}{2 \times b}.$$
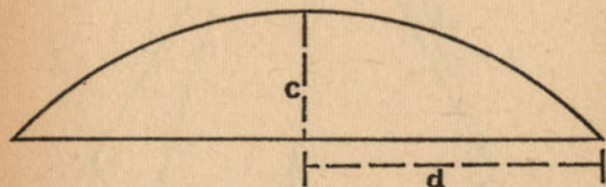
To find the diameter of the Circle to which any Segment may belong. Square half the cord, then divide it by the height of the segment; now add this to the height of the segment.

i.e. Diameter equals $\frac{d^2}{c} + c$.
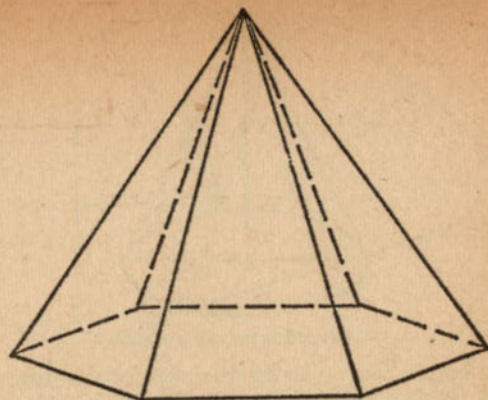
Area of Pyramid

Multiply the perimeter of the base by half the slant height, now add the area of the base.
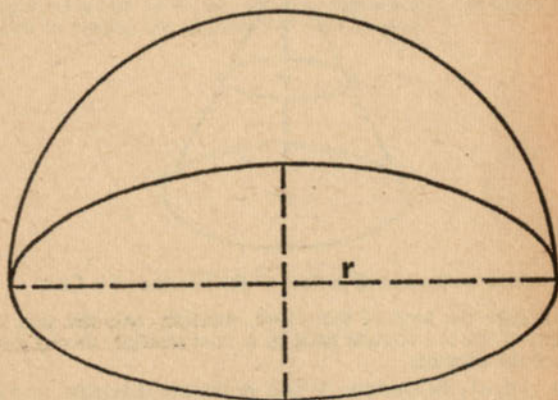
Area of Sphere

Area of a sphere equals four times the area of the diametrical section.
i.e. If *r* equals radius, area equals $4 \times r^2 \times \pi$.
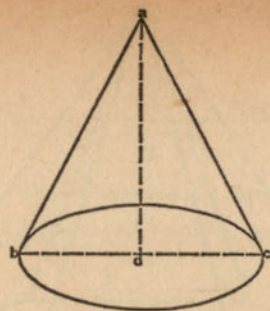
Area of Surface of a Cone

Area of surface of a cone equals the circumference of the base multiplied by one-half the slant height of the cone added to the area of the base.

i.e. If *ab* is the slant height, *bc* the diameter and *bd* the radius of the base, area equals $\dfrac{bc \times \pi \times ab}{2} + (cd)^2 \times \pi$.
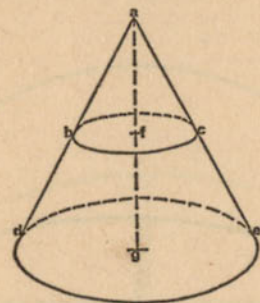
Area of the curved surface of the Frustum of a Cone

To determine the area of the above, multiply half the sum of the diameters of the two circular ends by π, now multiply this by the slant height of the frustum.

i.e. If *b, c, d, e* is the frustum, *bc* and *de* the two diameters, and *bd* the slant height, area equals $\dfrac{bc + de}{2} \times \pi \times bd$.
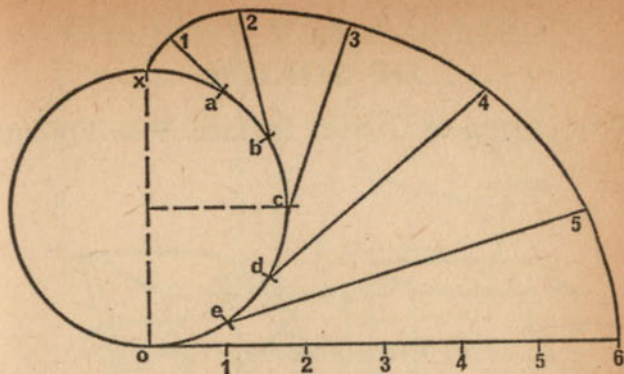
Involute Curve

If a point in a circle be unwound and extended in a straight line, the path of the point will form an involute curve.

To construct an involute – *ocx* is the circle and *o6* is a tangent equal in length to half the circumference of the circle. Now divide both the tangent and the semi-circle into any number of equal parts. From these points on the circle, *a, b, c, d, e*, draw tangents to the circle, *a1, b2, c3*, etc., equal in length to *o1, o2, o3*, etc., respectively. The curve is then described by joining the terminus of each tangent.

SURFACES AND VOLUMES
OF SOLIDS

S = Lateral or Convex Surface. V = Volume
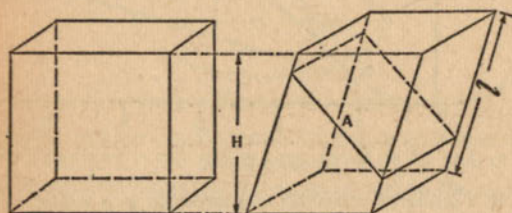
Parallelopiped

S = P*l*. P is perimeter perpendicular to sides: *l* is lateral length.
V = BH. B is area of base; H is perpendicular height.
V = A*l*. A is area of section perpendicular to sides: *l* is lateral length.
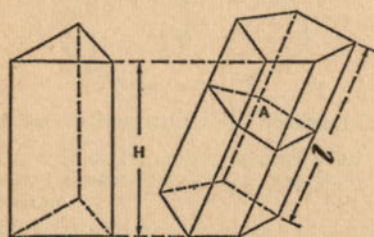
Prism, Right or Oblique, Regular or Irregular

S = P*l*. P is perimeter perpendicular to sides: *l* is lateral length.
V = BH. B is area of base: H is perpendicular height.
V = A*l*. A is area of section perpendicular to sides: *l* is lateral length.
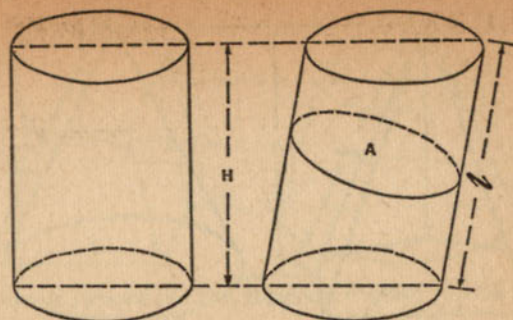
Cylinder, Right or Oblique, Circular or Elliptic, etc.

S = PH. P is perimeter of base: H is perpendicular height.
S = P_1*l*. P_1 is perimeter perpendicular to sides: *l* is lateral length.
V = BH. B is area of base: H is perpendicular height.
V = A*l*. A is area of section perpendicular to sides: *l* is lateral length.
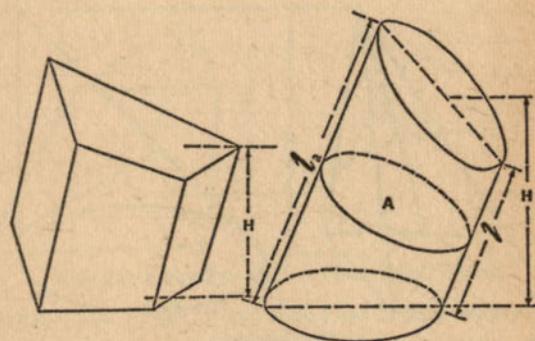
Frustum of any Prism or Cylinder

V = BH. B is area of base: H is perpendicular height from base to centre of gravity of top.
V = $\frac{1}{2}$A(l_1 + l_2), for cylinder.
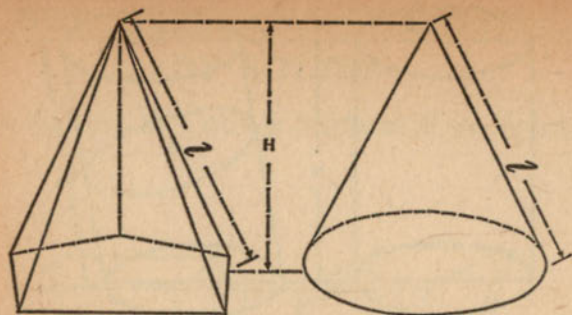
Pyramid or Cone, Right and Regular

$S = \frac{1}{2}Pl.$ P is perimeter of base: l is slant height.

$V = \frac{1}{3}BH.$ B is area of base: H is perpendicular height.
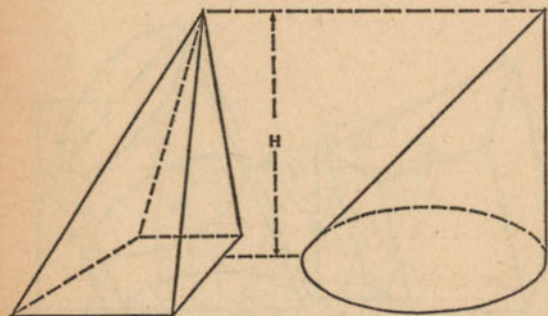
Pyramid or Cone, Right or Oblique, Regular or Irregular

$V = \frac{1}{3}BH.$ B is area of base: H is perpendicular height.

$V = \frac{1}{3}$ volume of prism or cylinder of same base and perpendicular height.

$V = \frac{1}{2}$ volume of hemisphere of same base and perpendicular height.

170
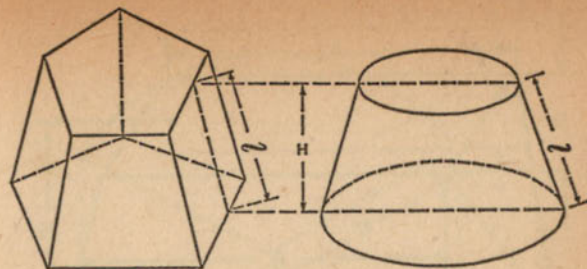
Frustum of Pyramid or Cone, Right and Regular, Parallel Ends

$S = \frac{1}{2}l(P + p)$ P and p are perimeters of base and top: l is slant height.

$V = \frac{1}{3}H(B + b + \sqrt{Bb}).$ B and b are areas of base and top: H is perpendicular height.
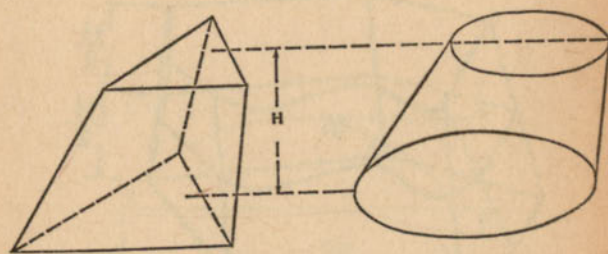
Frustum of any Pyramid or Cone, Parallel Ends

$V = \frac{1}{3}H(B + b + \sqrt{Bb}).$ B and b are areas of base and top: H is perpendicular height.

171
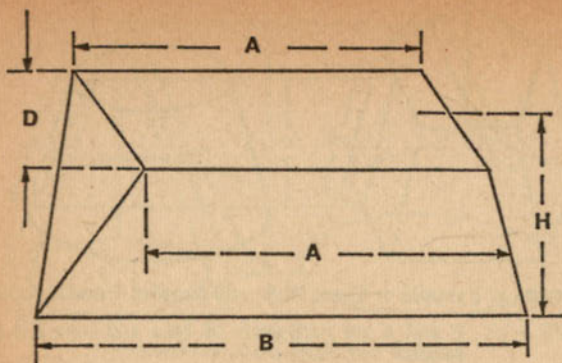
Wedge, Parallelogram Face

$V = \frac{1}{6}DH(2A + B)$. A, B, A are the lengths of the three edges: H is perpendicular height; D is perpendicular width.
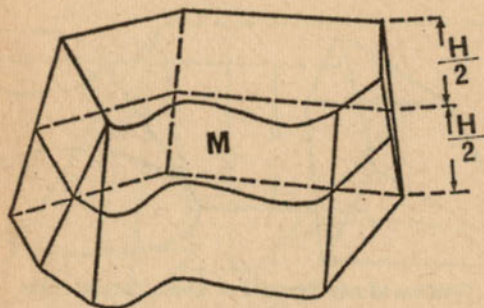
Prismatoid

$V = \frac{1}{6}H(B + b + 4M)$. B and b are areas of base and top: H is perpendicular height: M is area of section parallel to bases, midway between them.

The Prismatoid formula applies also to any of the foregoing solids with parallel bases, to pyramids, cones, spherical sections, and to many solids with irregular surfaces.
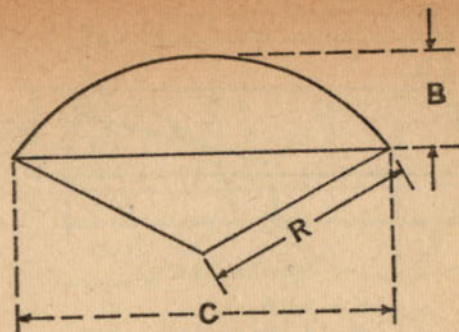
Spherical Sector

$$S = \frac{1}{2}\pi R(4B + C)$$
$$V = \frac{2}{3}\pi R^2 B$$
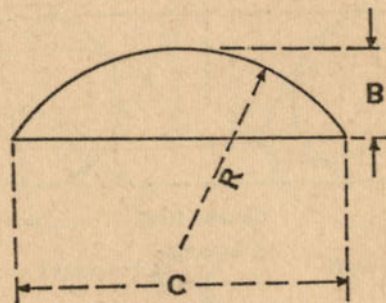
Spherical Segment

$$S = 2\pi RB = \frac{1}{4}\pi(4B^2 + C^2)$$
$$V = \frac{1}{3}\pi B^2(3R - B) = \frac{1}{24}\pi B(3C^2 + 4B^2)$$
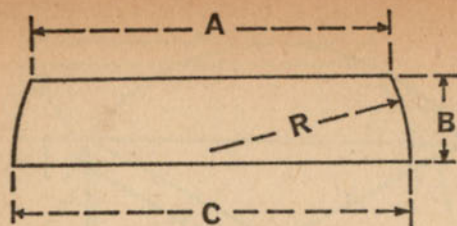
Spherical Zone

$$S = 2\pi RB$$
$$V = \tfrac{1}{24}\pi B(3A^2 + 3C^2 + 4B^2)$$
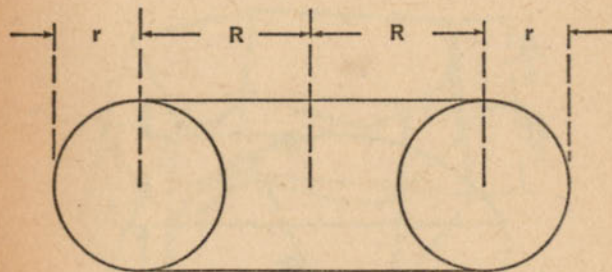
Circular Ring

$$S = 4\pi^2 Rr$$
$$V = 2\pi^2 Rr^2$$
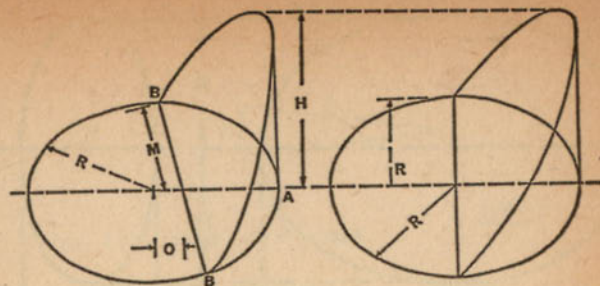
Ungula of Right, Regular Cylinder

Base = Segment BAB

$$S = (2RM - O \times \text{arc, BAB})\frac{H}{R - O}$$

$$V = (\tfrac{2}{3}M^3 - O \times \text{area, BAB})\frac{H}{R - O}$$

Base = Half Circle

$$S = 2RH$$

$$V = \tfrac{2}{3}R^2 H$$
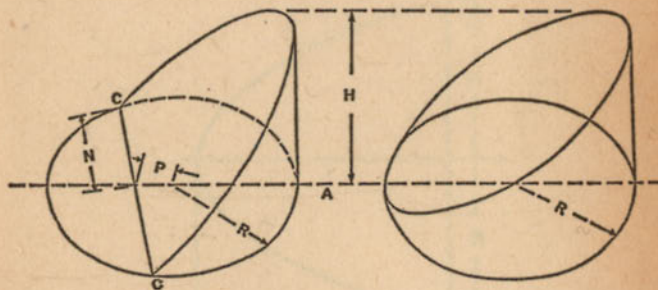
Base = Segment, CAC

$$S = (2RN + P \times \text{arc, CAC})\frac{H}{R + P}$$

$$V = (\tfrac{2}{3}N^3 + P \times \text{area, CAC})\frac{H}{R + P}$$

Base = Circle

$$S = \pi RH$$
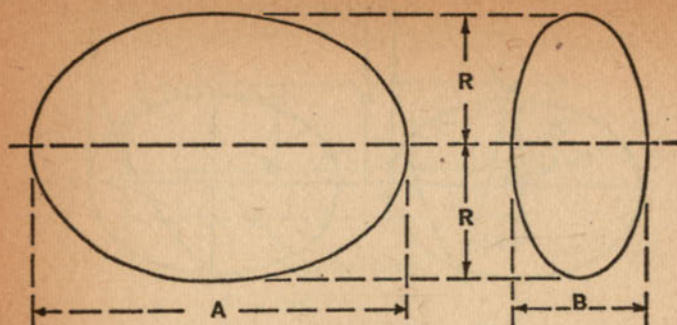
$$V = \tfrac{1}{2}\pi R^2 H$$

Ellipsoid

$$V = \tfrac{1}{3}\pi RAB$$
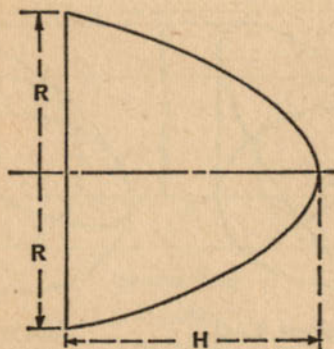
Paraboloid

$V = \tfrac{1}{2}\pi R^2 H$

Ratio of corresponding volumes of a Cone, Paraboloid, Sphere, and Cylinder of equal height $= \tfrac{1}{3} : \tfrac{1}{2} : \tfrac{2}{3} : 1$.
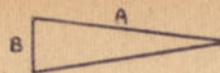
TO FIND ANGLE OF A WEDGE $\dfrac{2\pi l A}{B}$

Logarithms and anti-logarithms

Sines and co-sines; tangents and co-tangents

Seccants, co-seccants, and their logarithms

Reciprocals, Napierian logarithms

Squares, Cubes and Roots

The complete metric system with full conversion tables

Speeds of Flow of Water, Tables of Density and Humidity

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